Sept.

BROADCAST WRNY STATION

25 Cent

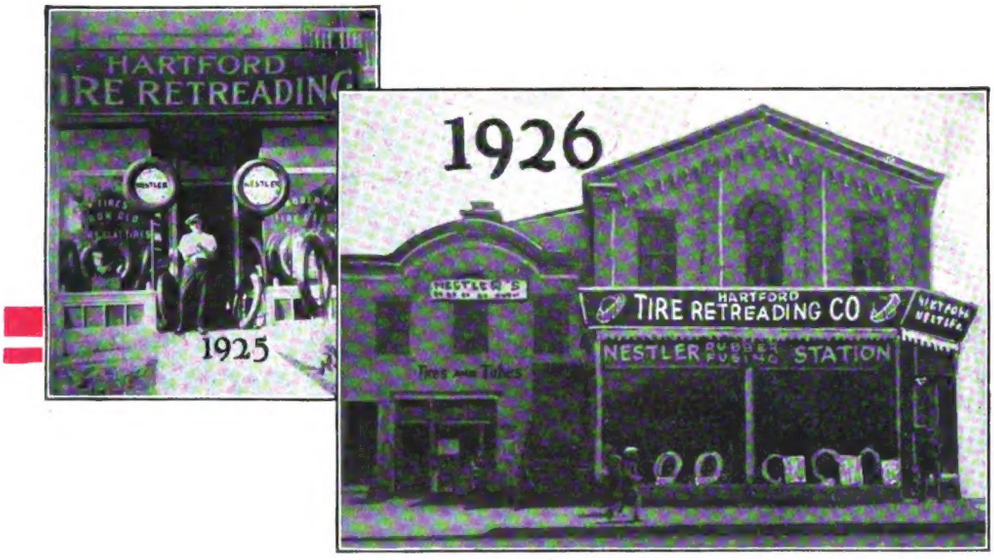
Science and Invention

With which is combined
The EXPERIMENTER

THE DREAM RECORDER

See Page 398

40 NON-TECHNICAL RADIO ARTICLES



"Read the facts about the amazing growth of Nestler Licensees. Make this success your own!"

EMIL NESTLER,
discoverer of the Nestler Rubber Fusing Process, is the recognized authority on tire retreading.

From $780 year store to $8200 year building in one year

Your community, too, needs Nestler Service

WHAT these two Hartford men have done, you too can do. Early in 1925, they secured a license to operate the patented Nestler Rubber Fusing Process in Hartford, Conn., and opened for business in a small $65 a month store. In twelve months they built up the *largest tire servicing business in the state* with no previous tire experience. An $8200 a year building has just been taken to give room to take care of a steadily increasing demand.

What is the Nestler Rubber Fusing Process and what does it do? Only a bare outline can be given here. It is a patented Process producing a de-vulcanization of rubber, by which a positive fusion or welding of new and old rubber can be produced at will. Nothing like it has ever been employed before. It makes possible the first practical and successful method of retreading pneumatic auto and truck tires, doubles the mileage at one-third the price of a new tire and saves car owners 50 per cent of their tire bills. It is creating a brand new industry.

An Enormous Market

A thousand miles of use takes but a few ounces of rubber from the tread of your tires. A tire considered worn out because of tread wear has actually lost only 15 per cent of its cost. Of the more than 34 million tires which are now annually junked, a large proportion could be made to do *double duty* with the Nestler Rubber Fusing Process. Since it was patented in 1920 the Nestler Rubber Fusing Process has been in practical use. Hundreds of thousands of tires are now being successfully Nestlerized annually.

Be President of Your Own Company

Think of the opportunity for a Nestler Rubber Fusing Station in your community. Previous experience unnecessary. Only moderate capital required. Earnings of $4,000 to $15,000 and more annually are now being made by Nestler Operators. Records of growth similar to the one in Hartford are being made all over the country!

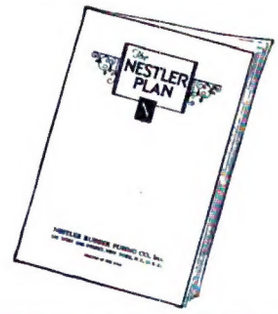
The Nestler Rubber Fusing Process is not only a better method of tire servicing, but is also more simple, cheaper and faster than any other method on earth.

Any man of average intelligence can master the Nestler Process in a few days time. Free instruction in the Nestler Rubber School or by mail is given all licensees. New plan makes it possible to *earn while you learn.*

The Nestler Plan

The Nestler Plan gives the full facts concerning the Nestler opportunity. It tells the methods used by the Hartford Tire Retreading Co., and hundreds of other successful Nestler Operators throughout the world in building prosperous businesses in their communities. Write for it today and we will also send you a copy of the Nestler catalog and a history of tire servicing methods which will show you the great advantages you will have. This is a proven, new and uncrowded field of business with an enormous demand and unlimited possibilities for growth. Present conditions are all favorable due to high tire prices. Write for the books today.

New Tires From Old. That is the Nestler Message in a nutshell.

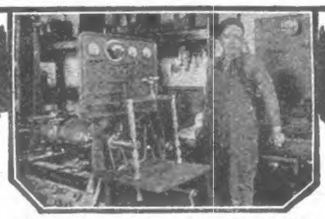


NESTLER RUBBER FUSING CO., Inc.
Dept. J-9, 245 W. 55th Street, New York, N. Y.

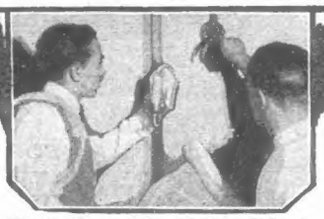
WRITE FOR IT TODAY!

MAKE BIG MONEY IN ELECTRICITY!

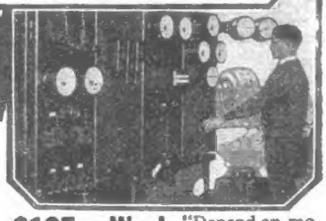
800% Pay Increase "I now make 8 times what I earned when I enrolled. I used to get $50 a month—now it's $400." Carroll Moeschler, Chaska, Minn.



$9,000 a Year Auto Electricity pays W. E. Pence, Albany, Ore., over $9,000 a year. 58 men enrolled for this training on his recommendation.



$1,000 a Month John Jirinec, 336 Ditmars Ave., Astoria, L. I., now earning $12,000 a year, says, "Cooke Training is responsible for my big income."



$125 a Week "Depend on me as a booster," says A. Schreck, Phoenix, Ariz. "I make over $500 a month. Your advertisement started me to success."

$700 in 24 Days "Thanks to you, I made $700 in 24 days in radio," says F. G. McNabb, 7 W. 16th St., Atlanta, Ga. "I recommend your training everywhere."

Thousands of Cooke Trained Men Earn $70 to $200 a Week!

Send the Coupon below for full particulars of my great pay-raising training—the training that has fitted thousands of men for jobs paying $3500 to $10,000 a year in Electricity

Be an ELECTRICAL EXPERT
Learn at HOME *in your* SPARE TIME!

Don't you keep on working for $25 or $35 a week. Get into Electricity. Thousands of Cooke Trained Men who knew nothing about it a short time ago are now earning $70 to $200 a week as Electrical Experts—and they don't work half as hard as you do. Why stick to your small pay job? Why stick to a line of work that offers no chance—no promotion—no big pay? Get into the world's greatest business. Electricity needs you. I'll show you how to do it. Get ready for the big-pay job now.

Electrical Experts are in Big Demand

Even ordinary electricians — the "screw driver" kind — are making big money, but trained men—Electrical Experts who get the top salaries—are needed more now than ever before. Thousands of Cooke Trained Men easily earn $3,500 to $10,000 a year. That's the kind of a job you want—where you can plan and boss and supervise the work of others or go into business for yourself. Get started towards one of these big-pay jobs now. Learn to earn $70 to $200 a week — you can do it with Cooke training — recommended by more than ten thousand successful graduates. Just mail the coupon below.

Employment Service—No Extra Charge

I will train you for a big-pay job and then help you get it **without extra charge.** Hundreds of employers look to me for the electrical men they hire. Last year I placed over one thousand men at big raises in pay. Hundreds of others were promoted by their employers through the help of my Vocational Service and other hundreds went into business for themselves with the help of my special Business Training. Mail coupon for big free book which explains this service and fourteen other features, many of which can't be had anywhere else.

Age or Lack of Experience Bars No One

You don't need experience. You don't have to be a College man. You dont have to be even a high-school graduate. As Chief Engineer of this big two million dollar institution which does a general Consulting Engineering Business besides operating one of the world's greatest Training Schools, I know just what training you need to make a big success in electricity. Let me give you that training with my simplified, complete home course—the world famous "Cooke" Training—built on my own 20 years of engineering experience with the help of nearly 50 other engineers. Learn to earn $70 to $200 a week — only spare time needed.

My Training Pays for Itself

You can start earning extra money a few weeks after you start my training. I give you special instruction for doing simple electrical jobs in your spare time—show you how to get these jobs and tell you what to charge. Many of my students make as high as $25 a week extra this way while studying. My course more than pays its own way.

Your Satisfaction Guaranteed

I am so sure I can make you a big success in Electricity, just like I have done for the men whose pictures you see here and thousands of others who now boost my training, that I will guarantee your satisfaction with a signed, money-back guarantee bond. If my training doesn't satisfy you after you have finished, you get back every penny you pay me. A two million dollar institution stands back of this guarantee.

My Big New Electrical Book FREE!

The 1926 Edition of my big book —"The Vital Facts About Electricity," is just off the press! Clip coupon NOW for your copy —it's FREE! 112 actual pictures of Electricity at work—dozens of success stories — what you can do in this Big-Pay-Profession — you'll find it all in my "up-to-the-minute" electrical book. Send for it today!

Get Started Now—Mail Coupon

Get my free book —"The Vital Facts About Electricity." Read about the success of hundreds of other men—men who recommend this training and whose names and addresses are given in my book. Get the real dope about your opportunities in Electricity. See how easy it is to get started on the road to jobs that pay $70 to $200 a week. Don't deny yourself this chance to make big money. Get the facts NOW—MAIL COUPON AT ONCE for the facts and my guarantee.

5 WONDERFUL WORKING OUTFITS ... GIVEN WITHOUT EXTRA CHARGE

1. **Laboratory and Experimental Outfit**—Complete material for interesting experiments.
2. **Bell and Alarm Outfit**—Electrical apparatus, material and tools—a complete installation Kit.
3. **Electric Lighting Outfit**—Switches, Wire, Lights, etc.—everything needed to make up all complicated electric lighting circuits.
4. **Electric Power Outfit**—Famous "Cooke" Motor and other apparatus. Not a toy—but a real, honest-to-goodness workable machine.
5. **Transformer Outfit**—Complete parts for building and winding this widely used equipment.

MAIL THE COUPON FOR FREE BOOK OF FACTS

The 'Cooke' Trained man is the 'Big Pay' Man

L. L. COOKE, Chief Engineer,
Chicago Engineering Works, Inc.
Dept. 26
2150 Lawrence Avenue
Chicago, Illinois

L. L. COOKE, Chief Engineer,
Chicago Engineering Works, Inc.,
Dept. 26
2150 Lawrence Avenue, Chicago, Illinois

Send me at once, without obligation, your big illustrated book and complete details of your Home Study Course in Electricity, including your outfit and employment service offers.

Name.....

Address.....

Occupation.....

Vol. XIV.
Whole No. 161

Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

September, 1926
No. 5

COMBINED WITH "THE EXPERIMENTER"
Member Audit Bureau of Circulations
EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City
GENERAL ADVERTISING DEPT.: 53 Park Place, New York City
Published by Experimenter Publishing Company, Inc.
(H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y).
Publishers of SCIENCE & INVENTION, RADIO NEWS, RADIO INTERNACIONAL, RADIO REVIEW and AMAZING STORIES

EDITORIAL STAFF

HUGO GERNSBACK, *Editor-in-Chief.*
H. WINFIELD SECOR, *Managing Editor.*
T. O'CONOR SLOANE, Ph.D. *Associate Editor.*
JOSEPH H. KRAUS, *Field Editor.*
J. FRANCIS CLEMENGER *Radio Editor.*
S. GERNSBACK, *Wrinkles Editor.*
M. ESSMAN, *Art Director.*

CONTRIBUTING EDITORS

Astronomy—
Dr. Donald H. Menzel, Ph.D., Ohio State University.
Isabel M. Lewis, M.A., of the U. S. Naval Observatory.
Entomology and Allied Subjects—
Dr. Ernest Bade, Ph.D.
Physics—
Dr. Harold F. Richards, Ph.D.
Ernest K. Chapin, M. A.
Dr. Donald H. Menzel, Ph.D., Ohio State University.
Automotive Subjects—
George A. Luers.
Chemistry—
Raymond B. Wailes.
Dr. Ernest Bade, Ph.D.
Radio—
A. P. Peck.
Herbert Hayden.
Magic and Psychic Phenomena—
Joseph Dunninger.
Joseph F. Rinn.
Edward Merlin.
Foreign Correspondents—
Dr. Alfred Gradenwitz, Germany.
Dr. H. Becher, Germany.
C. A. Oldroyd, England.
S. Leonard Bastin, England.
Count A. N. Mirzaoff, France
Hubert Slouka, Czecho-Slovakia.
P. C. van Petegem, Holland.
Richard Neumann, Austria.

IN OCTOBER ISSUE

Could Noah's Ark Hold All the Animals?

The modern scientific viewpoint is illustrated and described in an interesting way. You will enjoy it.

How North Pole Airplane Flight Was Navigated

How Commander Byrd navigated his airplane to the North Pole and back, explained with simple diagrams by an aeronautical engineer.

Winter House Garden

An interesting and seasonal article by the well-known authority on flowers, Dr. Ernest Bade.

Pipe Contest

What can you do with iron or other pipe and fittings? New prize contest will appear in the next number.

How to Read Blueprints

A subject which is engaging the attention of more people than ever before. This article will be profusely illustrated with photos and diagrams, making the subject as plain as A B C.

Contents for September

Editorial 395
By Hugo Gernsback
Ocean Stations For Airplanes 396
The Dream Recorder 398
By Hugo Gernsback
The World's Greatest Cataclysm 400
By Prof. Donald H. Menzel
Hunting Whales With Airplanes... 402
By H. Winfield Secor
S-51 Finally Raised 403
Microscopic Engraving 404
By R. P. Tolman
Odd and Unusual Patents 405
By Stuart Walker
Our Spiritualistic Investigations.... 406
By "Dunninger"
Simple Spirit Tricks 407
By Walter B. Gibson
The Month's Scientific News Illustrated 408
By George Wall
Science Steps Ahead 409
New Auto Tires From Old Ones.... 410
Home Mechanics—How to Build a Maple-wood Desk 411
By William M. Butterfield
The Home Scientific 412
Motor Hints—A New Monthly Department 413
By George Arthur Luers
Matchcraft—Monthly Prize Awards. 414
Magic 417
By "Dunninger"
Into The Fourth Dimension—A New Scientific Story 418
By Ray Cummings
Scientific Problems and Puzzles 420
By Ernest K. Chapin
Everyday Chemistry 421
By Raymond B. Wailes
Model Department—Award of Monthly Silver Cup 422
Experimental Chemistry Department 424
Experimental Electrics 426
Junior Electrician 428
How to Build an Inlaid Checkerboard 429
Unique Knockdown Settee 431
How-to-Make-It Department 432
Wrinkles, Recipes and Formulas ... 433
Edited by S. Gernsback
Readers Forum 434
Radio Department 435
WRNY Celebrates The First Birthday 436
By Charles D. Isaacson
How to Build a Cone Speaker 437
Building a Good Box Loop 438
By Herbert E. Hayden
160 and 320 Volt "B" Eliminator... 439
By A. P. Peck
Radio Oracle 440
Scientific Humor 441
Latest Patents 442
Oracle 443
Patent Advice 452

HOW TO SUBSCRIBE FOR "SCIENCE AND INVENTION." Send your name, address and remittance to Experimenter Publishing Co., 53 Park Place, New York City. Checks and money orders should be made payable to Experimenter Publishing Co., Inc. Mention the name of the magazine you are ordering inasmuch as we also publish RADIO NEWS, RADIO INTERNACIONAL, RADIO REVIEW and AMAZING STORIES. Subscriptions may be made in combination with the other publications just mentioned at special reduced club rates. Send postal for club rate card. Subscriptions start with the current issue unless otherwise ordered.
ON EXPIRATION of your subscription we enclose a renewal blank in our last number to you, and notify you by mail. Then unless we receive your order and remittance for a renewal, delivery of the magazine is stopped.
CHANGE OF ADDRESS: Notify us as far in advance as possible, giving your old address as well as the new one to which future magazines are to go. It takes several weeks to make an address change on our records.

SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 53 Park Place, New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication.

SCIENCE AND INVENTION. Monthly. Entered as second class matter May 10, 1923, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Long Island City, N. Y., and San Francisco, Calif. Title Registered at the Patent Office. Copyright, 1926, by E. P. Co., Inc., New York. The Contents of this Magazine are copyrighted and must not be reproduced without giving full credit to the publication. SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada. European Agents, S. J. Wise Et Cie, 40 Place Verte, Antwerp, Belgium.

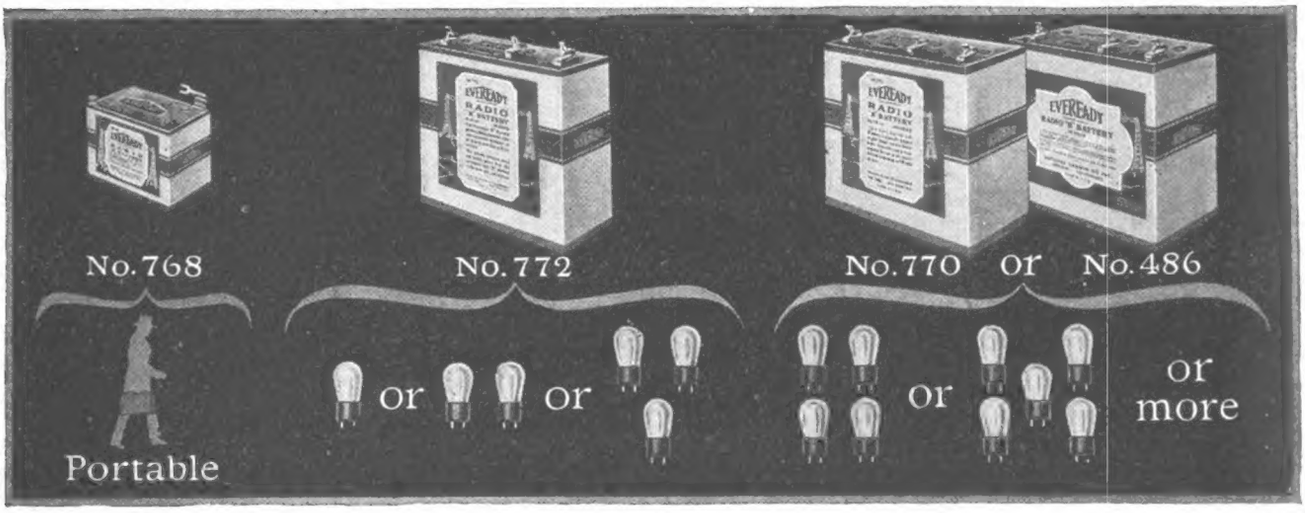
New England Advertising Representative
T. F. Magrane
Park Square Bldg., Boston, Mass.

Western Advertising Representatives
Finucan & McClure
720 Cass St., Chicago, Ill.

Pacific Coast Advertising Representatives
A. J. Norris Hill Co.
San Francisco, Cal., 5 Third St.
Los Angeles, Cal., 412 W. 6th St.

Kansas City Advertising Representatives
Davies & Dillon
15 W. 10th St., Kansas City, Mo.

Perhaps you, too, can cut your "B" battery costs in half. Just follow the chart. It gives you the secret of "B" battery economy.



THOUSANDS of people have made the discovery that Eveready "B" Batteries, when used in the proper size, and on sets equipped with a "C" battery*, are a most economical, reliable and satisfactory source of radio current.

Here is the secret of "B" battery economy, reliability and satisfaction:

On all but single tube sets —Connect a "C" battery. The length of service given below is based on its use.*

On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes— Use the Heavy-Duty "B" Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

These figures are based on the average use of receivers, which a country-wide survey has shown to be two hours daily throughout the year. If you listen longer, of course, your batteries will have a somewhat shorter life, and if you listen less, they will last longer.

Evereadys give you their remarkable service to the full only when they are correctly matched in capacity to the demands made upon them by your receiver. It is wasteful to buy batteries that are too small. Follow the chart.

In addition to the batteries illustrated, which fit practically all the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. There is an Eveready dealer nearby.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
New York San Francisco
Canadian National Carbon Co., Limited
Toronto, Ontario

*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a "C" battery.

EVEREADY
Radio Batteries
-they last longer

Tuesday night means Eveready Hour —8 P. M., Eastern Standard Time, through the following stations:

WEAF–*New York*
WJAR–*Providence*
WEEI–*Boston*
WTAC–*Worcester*
WFI–*Philadelphia*
WGR–*Buffalo*
WCAE–*Pittsburgh*
WSAI–*Cincinnati*
WTAM–*Cleveland*
WWJ–*Detroit*
WGN–*Chicago*
WOC–*Davenport*
WCCO { *Minneapolis* / *St. Paul*
KSD–*St. Louis*

INDEX TO ADVERTISERS

Page

A

Acme Pants matchers 477
American Bazaar, Inc. 458,460
American Correspondence School of Law 454
American Sandow, Inc., The ...451
American School of Aviation ...475
American School of Correspondence 393, 446
American Telephone & Telegraph Co. 461
Anita Company, Inc. 476
Arrow Battery Co. 476
Audel & Co., Theo. Inside back cover
Auto Strop Safety Razor Co. ..450

B

Balda Art Service 474
Berge Co., Jo. 469
Blandin, Ernest W. 471
Bliss Electrical School 461
Bogue Institute for Stammerers.476
Buescher Band Instrument Co...473
Bureau of Inventive Science 389, 471

C

Capitol Candy School 460
Chemical Institute 390
Chicago Engineering Works 385
Chicago Solder Co. 475
Chicago Technical College 446
Churchill Hall 464
Coast Guard Preparatory School 469
Coleman, Watson E. 454
Conn, Ltd., C. G. 475
Consrad Co., Inc. 465, 472, 480
Coyne Electrical School 473

D

Deninger Price Cutter 476
Douglas, Lyle 477

Page

E

Elto Outboard Motor Company .477
Evans, Victor J. 455

F

Fawcett Publications, Inc. 470
Federal Mail Order Corp. 460, 475, 476
First Hawaiian Conservatory of Music 469
Fisher Mfg. Co., Adam 454
Franklin Institute 463

G

General Electric Co. 463
Gerold Company, The 469
Gilson Slide Rule Company 461
Givens Chemical Company 474
Gordon, Milton 471

H

Hardin-Lavin Co. ... .476
Hobart Bros. 461
Hotel Martinique 460
Hotel Touraine 474

I

International Body Works 477
International Correspondence Schools 454, 460, 471, 476
International Studios 477
Irwin Aircraft Company 471

J

Johnson Smith Co. 447

K

Kenilworth Inn 473
Kirk, W. J. 459

Page

L

Lacey & Lacey 454
La Salle Extension University ..454
Lancaster & Allwine 452
Lincoln Standard Aircraft 454

Mc

McClure Publishing Co. 392
McGraw-Hill Book Company 457

M

Mack Laboratories 446
Madison Moore Radio Corp. 467
Math Pony Publishing Co. 476
Mellinger Tire & Rubber Co. 476
Metal Cast Products Co. 474
Mid-West Radio Corp. 477
Miller, Monroe 454
Modelmaker 473
Munn & Company 454

N

National Automotive School Back cover
National Carbon Company 387
National Radio Institute 394
Nestler Rubber Fusing Co. Inside front cover
New York Electrical School 448
North American Institute 391
N. Y. Institute of Music 477

O

O'Brien, Clarence A. 453
Owen, Richard B. 452
Ozment, C. J. 460

P

Parker, C. L. 454
Parks Ball Bearing Machine Co. 458
Pennsylvania Hotel 462
Physical Culture 448, 468

Page

Plapao Company 471
Plymouth Rock Squab Co. 477
Polachek, Z. H. 454
Polk & Co., R. L. 476
Porter Chemical Co. 477
Press Guild, Inc. 456

R

Radio Association of America ..475
Radio Specialty Co. 449
Randolph & Co. 452

S

Sasnett, Edward C 454
School of Engineering 467, 469
Sea Arts Guild 477
Seaver Williams Co. 464
Shipman Ward Co. 474
Stransky, John A. 476
Strongfort, Lionel 476

T

Tamblyn School 469
Tarbell System, Inc. 465
Tri-Une Company 469

U

United Factories Bureau 454

V

Vac-U-Swat Co. 464
Van Horne Co., The 445
Vuolo, Alphonso 452

W

Washington School of Art 458
Washington School of Cartooning 456
Washington Show Card School..474
Western Airplane Corp. 474
Witte Engine Works 471
World Battery Co. 473, 474

SCIENCE and INVENTION READERS' BUREAU

TEAR ALONG THIS LINE

Time and Postage Saver

IN every issue of SCIENCE AND INVENTION you undoubtedly see numerous articles advertised about which you would like to have further information.

To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalog or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in SCIENCE AND INVENTION.

TO: READERS' SERVICE BUREAU,
EXPERIMENTER PUBLISHING CO., Inc., 53 Park Place, New York, N. Y.

S&I 9-26

FROM WRITE YOUR NAME and ADDRESS HERE:

NAME .....

ADDRESS .....CITY, STATE .....

Gentlemen: Please advise the firms listed below that I would like to recieve detailed information on their product as advertised in the ..... issue of SCIENCE AND INVENTION.

☞This form should not be used for technical questions.

NAME	ADDRESS (Street—City—State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted check in this column.

☐ Check here if you are a dealer

Your Dealer's Name .....

Address .....

HOW TO INVENT— WHAT TO INVENT

and What to Do About Protecting and Selling An Invention

ALTHOUGH the fact has been universally recognized that Invention is governed by a few simple, easily acquired, fundamental principles, no one ever thought of putting these principles in black and white so that everybody interested in invention could read them. In spite of the fact that Thomas A. Edison made his famous statement that invention should be taught as a science, thousands of people continued to work blindly, doggedly, haphazardly to perfect their ideas.

But now anyone can learn how to invent. Fifteen famous inventors have at last given to the world the laws and principles of Inventive Science. They have shown every ambitious man and women how to invent. They are teaching Invention exactly as other people are teaching law, medicine, bookkeeping. Instead of spending years groping blindly, instead of wasting your time in useless, heartbreaking drudgery, you learn how to complete your ideas quickly *and what to do about them* when they are completed. You learn how to think so you are sure to succeed.

—How to develop your imagination
—How to develop your ideas
—How to get the facts you need for inventions
—How to keep legal records of ideas
—How to use scientific principles of mechanics
—How to avoid wasting time on impractical inventions
—How to apply for a patent
—How to organize a company
—How to protect your rights
—How to market a patent
and hundreds of other vitally important facts which EVERY successful inventor knows and uses.

Raymond F. Yates, who with fourteen other famous inventors now makes it easy for you to learn how to invent in your spare time at home.

Everybody Invents

For a long time it was commonly believed that every invention was a matter of pure luck—the result of some happy inspiration that suddenly flashed through a man's brain, and which made him fabulously rich without the slightest effort or thought. But you can prove for yourself that this is not so. You can prove for yourself that invention is the result of thinking and action along definitely exact, scientific lines.

Suppose when you went home tonight you found a window rattling. Through your mind would flash, almost instinctively, a regular order of thoughts which characterize the coneption and completion of every invention the world has ever known. First, you would recognize a problem to be solved—the rattling of the window. Then you would think of several principles of science or mechanics which would solve your problem. You might think of the scientific fact that if you poured water on the frame the wood would swell and tighten the window. You might think of using a nail. But what you most poobably would do would be to use the oldest mechanical principal known to man, the wedge.

What Invention is

Brought down to its simplest terms, that is exactly the way every invention has been made—combining two ideas; a problem which mustt be solved and a fact of mechanics or science which solves the problem. So, although you may never have thought of it just this way, every time you solve a problem in you daily life—at home, traveling, or in business—you are an inventor; you use the principles of thought and action which govern the Science of Invention!

You can see, therefore, how easy it is for you to develop your natual instinct to "fix things." The same processes of thought that almost instinctively told you to fix a rattling window with a wedge can be so well developed that you can learn to invent other things almost as easily and quickly. You know, too, that every invention is made only by thinking inventively. And every inventor is agreed that the principles of Inventive Science are so simple, so easy to learn that anyone, regardless of training or education, can develop himself to become a successful inventor!

With every new advance, with every new discovery that the world experiences, more problems are coming up—and more inventions are needed to solve these problems. Now, as never before, are new inventions wanted, and the world will pay a fortune to the man or woman who gives it just one of the inventions it needs.

Even little ideas can bring you a fortune. Eberhard, who invented the rubber on the end of a pencil, has been paid hundreds of thousands of dollars for his simple idea. The man who invented the metal tip for shoelaces, the man who conceived the idea of the "humped" hairpin, the man who developed the metal tape measure, all have achieved success and wealth as great or greater than the inventors of large machinery.

Learn How to Invent at Home

If you would like to develop your natural inventive ability along *money-making* lines, instead of trifling with ideas—if you would like to DO something about your ideas instead of letting someone else patent and market them ahead of you, let this great Course in Inventive Science help you. Get the advice and help of the fifteen famous inventors who tell you the secrets of invention which you MUST know to be successful.

This is the first course in practical invention that has ever been devised. In simple, easy-to-understand language you are told how successful inventors work; you learn how to think along inventive lines, you learn the short-cuts to successful invention; you learn how to use the secrets of invention that convert a simple little idea into money.

No one step in invention has been omitted. Everything you want to know about invention—developing your ideas, securing information you need, how to apply for patents, how to protect your rights, how to sell your invention—are taken up step by step, so that when you have completed the course you have a wealth of information worth thousands upon thousands of dollars.

Only $2.95 For Entire Course of 25 Lessons—You Are Protected by Money Back Guarantee

We will send you the entire course of twenty-five lesons, as described above, with the privilege of ten days' inspection. Pay only $.295, plus a few cents postage, to the postman who delivers the course. This money will be returned to you at once if you decide to return the lessons within the time allowed.

This Bureau is not connected in any way with patent attorneys or manufacturers. Our only wish is to help ambitious men and women to develop their inventive ability—to become successful inventors.

Perhaps only one little idea, as simple as the snapfastener or "crimped hairpin", will bring you thousands of dollars. These two examples brought fortunes to the men who first thought of them. The man who whittled out the first "Kiddie Kar" for his own child is said to have made $5,000,000 out of it. Is there any better way to spend your spare time? One little idea may win a fortune for you!

Send no money. Just write your name and address on the coupon below, or send a postcard. But do it TODAY. Under our moneyback guarantee, can you AFFORD to overlook this opportunity? It may place a fortune within your grasp!

Bureau of Inventive Science
Dept. 79, Wisner Building, Rochester, N. Y.

BUREAU OF INVENTIVE SCIENCE,
Dept. 79, Wisner Bldg., Rochester, N. Y.

Please send me your complete course of 25 lessons. I will pay the postman $2.95, plus postage, which will be returned to me at once if I return the Course within ten days.

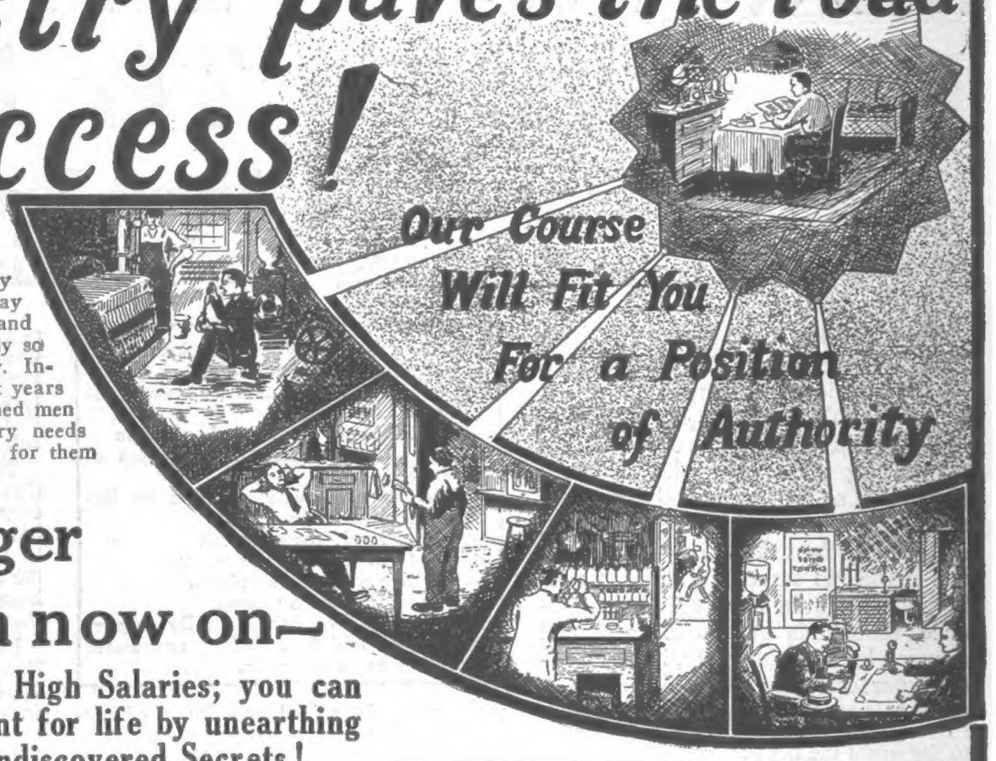
Name .....

Address .....

City ..... State.....

Outside of U. S. $3.25 cash with order.

Chemistry paves the road to Success!



Some people measure success in terms of money and others in degree of knowledge and culture. Chemistry is the one uncrowded profession today that offers both. America, always a land of amazing opportunities, is especially so now in the field of applied Chemistry. Industries have developed within eight years more rapidly than the output of trained men to conduct them. Every big industry needs chemists and there is a real demand for them immediately.

Earn a Bigger Salary from now on—

Good Chemists Command High Salaries; you can make yourself independent for life by unearthing one of Chemistry's Undiscovered Secrets!

Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They *are* done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $40,000 prizes every year for the advancement of science and peace. Herman Frasch, who showed how to extract sulphur built up a huge fortune. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

NOW IS THE TIME TO STUDY CHEMISTRY

Not only are there boundless opportunities for amassing wealth in Chemistry, but the profession affords congenial employment at good salaries to hundreds of thousands who merely follow out its present applications. These applications are innumerable, touching intimately every business and every product in the world. The work of the chemist can hardly be called work at all. It is the keenest and most enjoyable kind of pleasure. The days in a chemical laboratory are filled with thrilling and delightful experimentation, with the alluring prospect of a discovery that may spell Fortune always at hand to spur your enthusiasm.

YOU CAN LEARN AT HOME

To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position, and let us educate you in Chemistry during your spare time. Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory.

EASY MONTHLY PAYMENTS

You don't have to have even the small price of the course to start. You can pay for it in small monthly amounts—so small that you won't feel them. The cost of our course is very low, and includes everything, even the chemistry outfit—there are no extras to buy with our course. Our plan of monthly payments places a chemical education within the reach of everyone.

SPECIAL 30 DAY OFFER

Besides furnishing the student with his Experimental Equipment, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

DON'T WAIT—MAIL COUPON NOW!

CHEMICAL INSTITUTE OF NEW YORK, Inc.

Home Extension Division 9

66-Z West Broadway **New York City**

LETTERS
From Students Who Have Taken This Course

You will probably be pleased to learn one of the lessons gave me an idea to turn my chemical knowledge to profitable account. I am now making a varnish and paint which undersells the other type products by $2.60 a gallon, in some cases more. Have been receiving gallon orders from painters during past week which has netted me a profit of $12.50 for my "spare-time chemical industry." Many thanks for your training thus far.

J. J. KELLY.

I am but half way through your course and am certain that I have saved my Company many times the cost of the course and raised myself in the Share Holders estimation. The knowledge obtained has its immediate practical application and I do not hesitate in saying your course and the personal attention you give is invaluable to the practical man in any business where chemistry plays a part. You may use this letter and my name and address to the furtherance of your good work.

JOHN WALTER.

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co., testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.

MORLAIS COUZENS.

T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

EXPERIMENTAL EQUIPMENT FURNISHED TO EVERY STUDENT

We give to every student without additional charge this chemical equipment, including forty-nine pieces of laboratory apparatus and supplies, and forty different chemicals and reagents. These comprise the apparatus and chemicals used for the experimental work of the course. The fitted heavy wooden box serves not only as a case for the outfit but also as a useful laboratory accessory for performing countless experiments.

CHEMICAL INSTITUTE OF NEW YORK
Home Extension Division 9
66-Z West Broadway, New York City

Please send me at once, without any obligation on my part, your free Book "Opportunities for Chemists," and full particulars about the Experimental Equipment given to every student. Also please tell me about your plan of payment and your special 30 day offer.

NAME .....

ADDRESS .....

CITY ..... STATE.....

S. I.-Sept.

Afraid *of* My Own Voice

But I Learned to Dominate - Others Almost Overnight

SUDDENLY the boss turned to me and queried, "Well, Conroy, what's your opinion?" They all listened politely for me to speak and in the silence I heard my thin, wavering voice stammering and sputtering a few vague phrases. Like a flash Stoddard interrupted me and launched on a brilliant description of his plan. All sat spellbound as he talked—my views were forgotton—and yet I have been studying the problem for months and I was prepared to suggest a sound, practical plan which I knew would solve all our difficulties.

And that was the way it always was—I was always being given opportunities to show my ability and always failing miserably. I was bashful, timid, and nervous—I never knew how to express myself, how to put my ideas across. In fact, I was actually afraid of my own voice! Constantly I saw others with less ability, less experience than I being promoted over my head—simply because they had the knack of forceful speech, self-confidence, and personality—the very qualities I lacked.

In social life, too, I was a total loss—I was always the "left-over"—the one who sat back and watched the others have a good time. I seemed doomed to be an all around failure unless I could conquer my timidity, my bashfulness, my lack of poise and inability to express myself.

In 15 Minutes a Day

And then suddenly I discovered a new easy method which made me a powerful speaker almost overnight. I learned how to bend others to my will, how to dominate one man or an audience of thousands. Soon I had won salary increases, promotion, popularity, power. Today I always have a ready flow of speech at my command. I am able to rise to any occasion, to meet any emergency with just the right words. And I accomplished all this by developing the natural power of speech possessed by everyone, but cultivated by so few—by simply spending 15 minutes a day in the privacy of my own home to this most fascinating subject.

What 15 Minutes a Day Will Show You

- How to talk before your club or lodge
- How to propose and respond to toasts
- How to address Board Meetings
- How to tell entertaining stories
- How to make a political speech
- How to make after-dinner speeches
- How to converse interestingly
- How to write letters
- How to sell more goods
- How to train your memory
- How to enlarge your vocabulary
- How to develop self-confidence
- How to acquire a winning personality
- How to strengthen your willpower and ambition
- How to become a clear, accurate thinker
- How to develop your power of concentration
- How to be the master of any situation.

There is no magic, no trick, no mystery about becoming a powerful and convincing talker. You, too, can *conquer timidity*, stage fright, self-consciousness and bashfulness, winning advancement in salary, popularity, social standing and success. Today business demands for the big, important high-salaried jobs, men who can dominate others—men who can make others do as they wish. It is the power of forceful, convincing speech that causes one man to jump from obscurity to the presidency of a great corporation; another from a small, unimportant territory to a sales-manager's desk; another from the rank and file of political workers to a post of national importance; a timid, retiring, self-conscious man to change almost overnight into a popular and much applauded after-dinner speaker. Thousands have accomplished just such amazing things through this simple, easy, yet effective training.

Send for this Amazing Book

This new method of training is fully described in a very interesting and informative booklet which is now being sent to everyone mailing the coupon below. This book is called, *How to Work Wonders With Words.* In it you are shown how to conquer stage fright, self-consciousness, timidity, bashfulness and fear—those things that keep you silent while men of lesser ability get what they want by the sheer power of convincing speech. Not only men who have made millions but thousands have sent for this book—and are unstinting in their praise of it. You are told how to bring out and develop your priceless "hidden knack"—the natural gift within you—which will win for you advancement in position and salary, popularity, social standing, power and real success. You can obtain your copy absolutely free by sending the coupon.

Now Sent FREE

NORTH AMERICAN INSTITUTE
3601 Michigan Ave., Dept. 1426, Chicago, Ill.

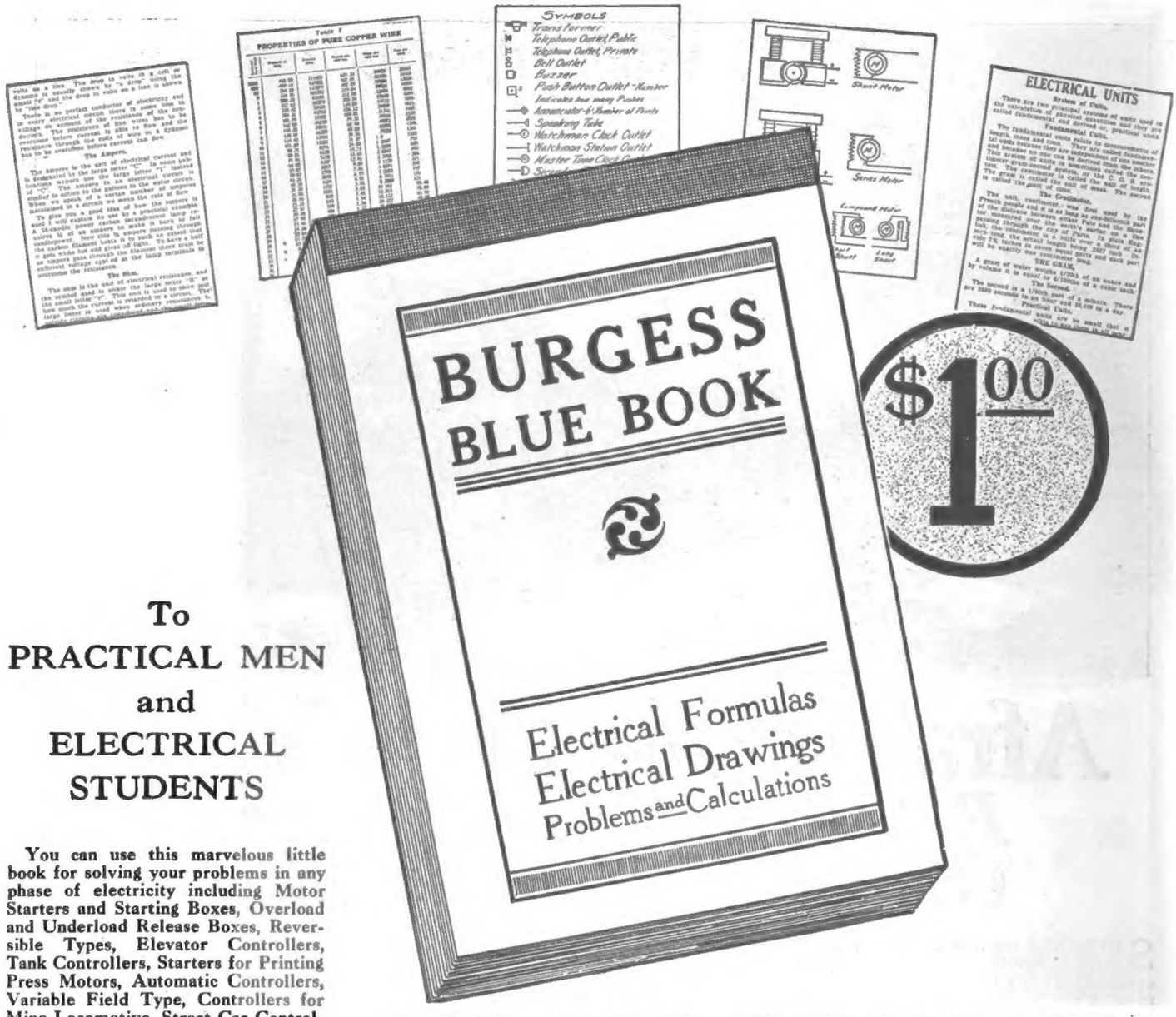
NORTH AMERICAN INSTITUTE,
3601 Michigan Ave., Dept. 1426
Chicago, Illinois

Please send me FREE and without obligation my copy of your famous book, *How to Work Wonders With Words.*

Name .....

Address .....

City..... State.....



To PRACTICAL MEN and ELECTRICAL STUDENTS

You can use this marvelous little book for solving your problems in any phase of electricity including Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotive, Street Car Controllers, Connections for Reversing Switches, Motor and Dynamo Rules, Rules for Speed Regulation, Connections for Induction Motors and Starters, Delta and Star Connections, Connections for Auto Transformers, and Transformers for Lightning and Power Purposes.

If you are interested in calculation you can find plenty of it in the various work on Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculation of Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, Calculation of Weight of Wire, Wire Gauge Rules, Orm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and Calculation of Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring of Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, Calculation of Size of Pulleys, Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Speed of Alternators and Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and Formulas for use with Line Transformers.

ARE YOU INTERESTED IN ELECTRICITY?

If you are, this is your opportunity to get a book which is as authentic as it is complete! For every problem that *has* puzzled you and *is* puzzling you, you will find the solution in clear, definite language in the BLUE BOOK. Its informatative contents come from the pen of Yorke Burgess, founder and head of the famous electrical school bearing his name. It is a pocket-size note book, especially adapted for the practical man and those who are taking up the study of electricity. You can have this note book with you at all times and you can read and study it in your leisure moments.

With all mailing charges postpaid, we will send you this excellent book for one dollar ($1.00). Just mail us your order, enclosing a dollar bill, a check, or a money order with your request for a copy. Knowing its value thoroughly, we are convinced that you will like the book, but after five days we will be glad to refund your dollar if you should care to return the book. Just drop us a line.

THE McCLURE PUBLISHING CO.

Dept. S. I. 9 **720 Cass Street, Chicago, Ill.**

3 Drafting Lessons Actually FREE!

to Prove You Can Learn at Home in Spare Time!

We have invented a new, simplified way to teach Drafting—the first real improvement in Drafting home-instruction in history. We want you to see it, try it—without one penny of cost or obligation. We want to show you how we get away from the **copying** methods used in the past. See how we make you **think**, solve problems, do actual drafting room jobs from the first lesson!

I WILL MAKE this Contract with You—

When you enroll for our home-training in Drafting, we agree to give you:

1. Complete Drafting training, by the new Practice-Method.
2. Professional Drafting Outfit, as illustrated.
3. *We will help you get a good Drafting position* at a substantial increase in pay.
4. Or we'll refund every cent of your money.

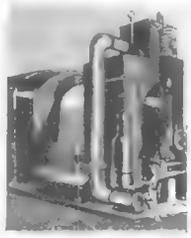
AMERICAN SCHOOL —the Million Dollar Educational Institution

Director Extension Work

The American School, a million dollar *No-Profit* Educational Institution now offers men a *double* service—training for a specific job, then finding the job. For one small price, on terms of only $5 a month, you are now assured of definite benefits, both in position and salary. Write for complete information—*today!*

Draftsmen Wanted! $60 to $125 a Week!

70,000 fine jobs advertised last year. Get ready to fill one. Get out of the rut. Make something of yourself. Plan your future in Drafting. Even if you have only common schooling, even if you know nothing of Drafting, we guarantee to make you a real Draftsman *or to refund your money!* Special surprise offer right now to the first 500 men who answer this ad—reduced price, easy terms. Coupon brings complete information.



Electricity needs Draftsmen who know Electrical principles as well as general Drafting practice. I give you this training.

A new, rapid, simplified training

Copying drafting lessons prepares you to be only a "tracer." This new "Job-Method" gives you actual drafting-room jobs in a new one-step-at-a-time way. With *pictures* which you can understand almost without reading the "lessons." And that is why the American School-trained Draftsmen can qualify for a good job at big pay when they graduate.

The demand for Draftsmen experienced in concrete and structural steel work is enormous. Many big-pay positions open.

5 BIG-PAY Branches

The big money in Drafting goes to men who specialize in Machine Design, or Electrical Drafting, or Architectural Drafting, or Structural, or Automotive. It is not enough merely to know *general* Drafting practice. You must know how to calculate and design and plan original work. You need many Engineering subjects to fill the kind of a Drafting position that pays $60 to $125 a week. The American School *now includes this specialized training in its Drafting course.*

Every great Auto factory employs Draftsmen who specialize in Automotive work—men who design bodies, plan engines, etc.

WIN SUCCESS THRU DRAFTING

Drafting is easy, fascinating work. Short hours. Big pay. And the Draftsman is always in line for promotion for executive positions. This training is Complete. It includes high-school subjects (if you need them) and all the Engineering and M-a-t-h-e-matics Drafting Experts require.

No machine can be built until the Draftsman first builds it on paper. My training prepares you for this work.

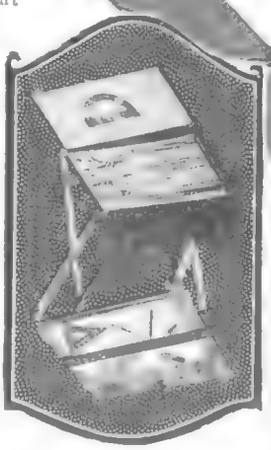
FREE Job Service!

The American School now offers its students and graduates, without cost, the services of an efficient Employment Department keeping in constant touch with employes of Draftsmen all over the United States. *We have placed hundreds of men in good big-pay Drafting positions.* We've made this training so complete, so practical, so easy to master, that our students *are bound to make good.* And, so, because the demand for real Draftsmen continues to exceed the supply, and because this training actually prepares men for good Drafting positions, *we back it with a Free Employment Service.*

Never has the world seen anything like the building boom of today. This has created enormous demand for real Draftsmen.

Coupon Brings 3 Lessons FREE!

Get them. Test your own ability to learn Drafting and get ready for a fine job and big pay. Coupon also brings surprise offer, and complete information about your opportunities for success in Drafting. *Mail It Today!*



Costly Drafting Outfit Given!

Fine, imported instruments like these help you learn Drafting quickly and easily. These standard quality, full size instruments, board, table, triangles, T square, ink, protractor, etc., given to every student without extra cost.

3 Drafting Lessons Actually FREE!

O. C. MILLER, Director of Extension Work

AMERICAN SCHOOL

Dept. D-626, Drexel Ave. & 58th St., Chicago.

Rush 3 Free Drafting Lessons, Job and Raise offer, complete information, money-back guarantee, etc., to prove I can become a real Draftsman at home in spare time.

Name .....

Street No. .....

City ..... State.....

O. C. MILLER, Director EXTENSION WORK **AMERICAN SCHOOL** Dept. D-626 Drexel Ave. & 58th St. CHICAGO

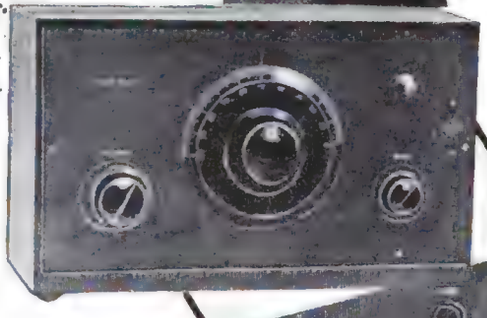
RADIO NEEDS TRAINED MEN!

I Will Train You At Home To Fill a Big Pay Radio Job

"I give you all this apparatus so you can learn quickly at home *the Practical Way*"

J. E. S.

FREE OF EXTRA COST



If you're earning a penny less than $50 a week, clip coupon now. Send for AMAZING FREE BOOK, "Rich Rewards in Radio." Why go along at $25 or $35 or $45 a week, when you could earn $50 to $250 in the same six days, as a Radio Expert? Hundreds of N. R. I. trained men are doing it—why can't you?

Earn $50 to $250 a Week—
RADIO EXPERTS IN BIG DEMAND

Radio needs trained men. Get into this new live-wire profession of quick success. It's the trained man, the Radio Expert, who gets the big jobs of this profession—paying $75, $100, $200 a week and up. Every day N. R. I. trained men are taking good places in the Radio field—men just like you—their only advantage is TRAINING. You can prepare just as they did, by new practical methods. Our tested clear training makes it easy for you. Big Free Book contains all the proof.

You Learn Quickly In Spare Time

So sure am I that I can train you successfully for a better future in this new Big-Pay profession, that I guarantee your training with a money-back bond. Lack of experience or education won't hold you back—common schooling all you need to start. You can stay home, hold your job, and learn quickly and pleasantly in your spare time. My practical, helpful methods enable you to start RIGHT AWAY toward one of the bigger Radio jobs paying $50 to $250 a week. No delay, no losing time from work — no scrimping or scraping to get your training.

Operates WMAQ

"Accepted a position with the Chicago Daily News Station WMAQ. MY INCOME PRACTICALLY DOUBLED, thanks to you. I handle all consultation, also do operating. Your course taught me not only the theoretical but also the practical knowledge that makes my work easy for me." Keith Kimball, Station WMAQ, Chicago, Ill.

You Get All of This

All instruments shown here and others sent to all my students free of extra cost under short time special offer Clip coupon now—find out all about this big unequalled offer while you still have time to take advantage of it. This training is intensely practical—these instruments help you do the practical work. You learn workmanship and get added confidence in your ability.

$70 In One Day For T. M. Wilcox

"I am in business for myself and RECENTLY MADE $70 in ONE DAY. I was an electrician of rich experience, occupying a splendid position as telephone superintendent when I enrolled with you believing it would open up greater opportunities—have not been disappointed. Estimate Radio will be worth tens of thousands of dollars to me in next few years." T. M. Wilcox, Belle Island, Newfoundland.

World Famous Training That "Pays for Itself"

My Radio course World-Famous as the training that "pays for itself." Make more money QUICK when you take up this practical course. Work on millions of antennae, receiving sets, offers you big chance to make spare time cash while you're learning. I'll show you how—teach you the latest "dope," furnish you with business cards, show you how to get the business and make it pay. My students don't wait a year to increase their income—they report QUICK INCREASES as a result of this course—often two or three weeks after starting.

Howard Luce, Friedens, Pa. made $320 in 7 weeks during spare time. D. H. Suitt Newport, Ark., writes, "While taking the course I earned in spare time work about $900." Earl Wright, Omaha, reports making $400 in a short time while taking course—working at Radio in spare time! Sylvester Senso, Kaukauna, Wis., made $500. These records not unusual—these men a few of hundreds.

Your Satisfaction Guaranteed

We who know the results this practical tested training gets—the increased earnings it has brought to men everywhere—stand behind it all the way with a signed guarantee bond that we give you when you enroll. On completion if you're not entirely satisfied in every way, you get back every cent you've paid us. No strings to this offer—you yourself are the only judge. Get started today! It's your big chance for one of the bigger Radio jobs—mail coupon NOW for my Big FREE BOOK and proof! No obligation.

Get This FREE BOOK

Most amazing book on Radio ever written—full of facts and pictures—tells all about the great new Radio field, how we prepare you and help you start. You can do what others have done—GET THIS BOOK. Send coupon today—no obligation.

J. E. SMITH, President
NATIONAL RADIO INSTITUTE
Dept. KX5, Washington, D. C.

MAIL THIS COUPON TODAY

J. E. SMITH, President
NATIONAL RADIO INSTITUTE
Dept. KX5, Washington, D. C.

Dear Mr. Smith—Without obligating me in any way, send me your free book, "Rich Rewards in Radio" and all information about your practical, home-study Radio Course.

Name.....Age.....

Street Address.....

Town.....State.....

EMPLOYMENT SERVICE TO ALL GRADUATES

Originators of Radio Home-Study Training

Volume XIV
Whole No. 161

Science and Invention

Sept., 1926
No. 5

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR, SLOANE, Ph.D., *Associate Editor*
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

SCIENTIFIC WEATHER FORECASTING

By HUGO GERNSBACK

IF any one had predicted, 500 years ago, the exact occurrence, to the second, of a solar or lunar eclipse for the coming year, or for ten years in advance, he would probably have been executed or burned at the stake, without much ado, for witchcraft. Astronomy, as we know today, is an exact science, and it is possible now to predict eclipses with certitude within a few seconds of their actual occurrence, not only for one year ahead but for centuries and thousands of years in the future, if necessary.

Weather predicting, particularly long-range weather predicting, has not been much of a success heretofore. The reason was that it was not founded upon an exact science. We do know, however, that the sun must of necessity be responsible for our weather in general. We know that it is the sun that, through its electromagnetic rays, transformed into heat in the outer layers of the air, has an important relation to the weather.

It is known to science that in the upper regions of our atmosphere the air currents are always about the same, while on certain parts of the earth, due to rotation of our planet and to solar activity combined, we have certain trade winds at almost exact times of the year. From such data it is not possible to make exact weather predictions because other variable data, up to this time, has been missing. This variable data has now been studied for a number of years by Dr. Charles G. Abbot of the Smithsonian Institute, who has recently discovered new proofs that the amount of heat given off by the sun from day to day, and from year to year varies. It is believed by Dr. Abbot that from such data that can be ascertained accurately, it will be possible in time to make long range weather predictions.

For some thirty years Dr. Abbot has been investigating sun phenomena and has measured the heat which it sends indirectly to the earth. In true scientific fashion, Dr. Abbot made measurements with exceedingly accurate instruments at various points of the earth, such as Mt. Wilson and Mt. Whitney, in California, at Bassour, Algeria, at Mt. Harqua Hala, in Arizona, and at Mt. Montezuma, in Chile, South America. He constructed wonderfully sensitive instruments, capable of measuring the millionth part of a degree change in temperature, with which to effect the intricate heat measurements.

Dr. Abbot plotted the measurements of the total quantity of heat received on the earth's surface. On the same paper he then plotted the solar constant-values over a number of years. These solar constant-values are the result of the measurements of the total quantity of heat received on the earth's surface, and then corrected measurements of the loss of heat through the earth's atmosphere so as to indicate the values as found, for instance, on the moon. The two results were closely parallel.

Not content with this Dr. Abbot also plotted the average number of sun spots for July of the same years on the same paper, and the harmony was again apparent. With this accomplished, the next step was to make the daily measurements of solar radiation as accurately as was humanly possible. The National Geographic Society has already donated $55,000 to establish a solar observatory at Mt. Brukkaros, in southwest Africa, in order to co-operate with Dr. Abbot's two existing stations in California and Chile. The outcome of all this will be that during the next few years it is hoped that by these methods it will be possible to acurately foretell weather conditions for any part of the world for weeks, and in some cases, months, ahead.

The problem is one of great complexity, because there are so many variable factors that enter into the calculation of such problems. For instance, the percentage of moisture in the air is most important and must be accurately known. This is easily ascertained by instruments which are already in use. Another and vital variable is contained in volcanic dust thrown out by volcanoes of the earth from time to time. Such volcanic dust is thrown up to great heights and the impalpable dust stays in the upper regions of the atmosphere for many months. The dust in this case acts as a sort of screen, and cuts off solar radiation, hence, during a volcanic outbreak, experience has shown that cooler weather may be expected, because less solar radiation reaches the earth.

Dr. Abbot in his selected measurements, made for the month of July for the years 1910 to 1920, was careful to omit the years 1912 and 1913, because the volcano of Mt. Katmai, in Alaska, filled the atmosphere of the whole northern hemisphere with volcanic dust during those years.

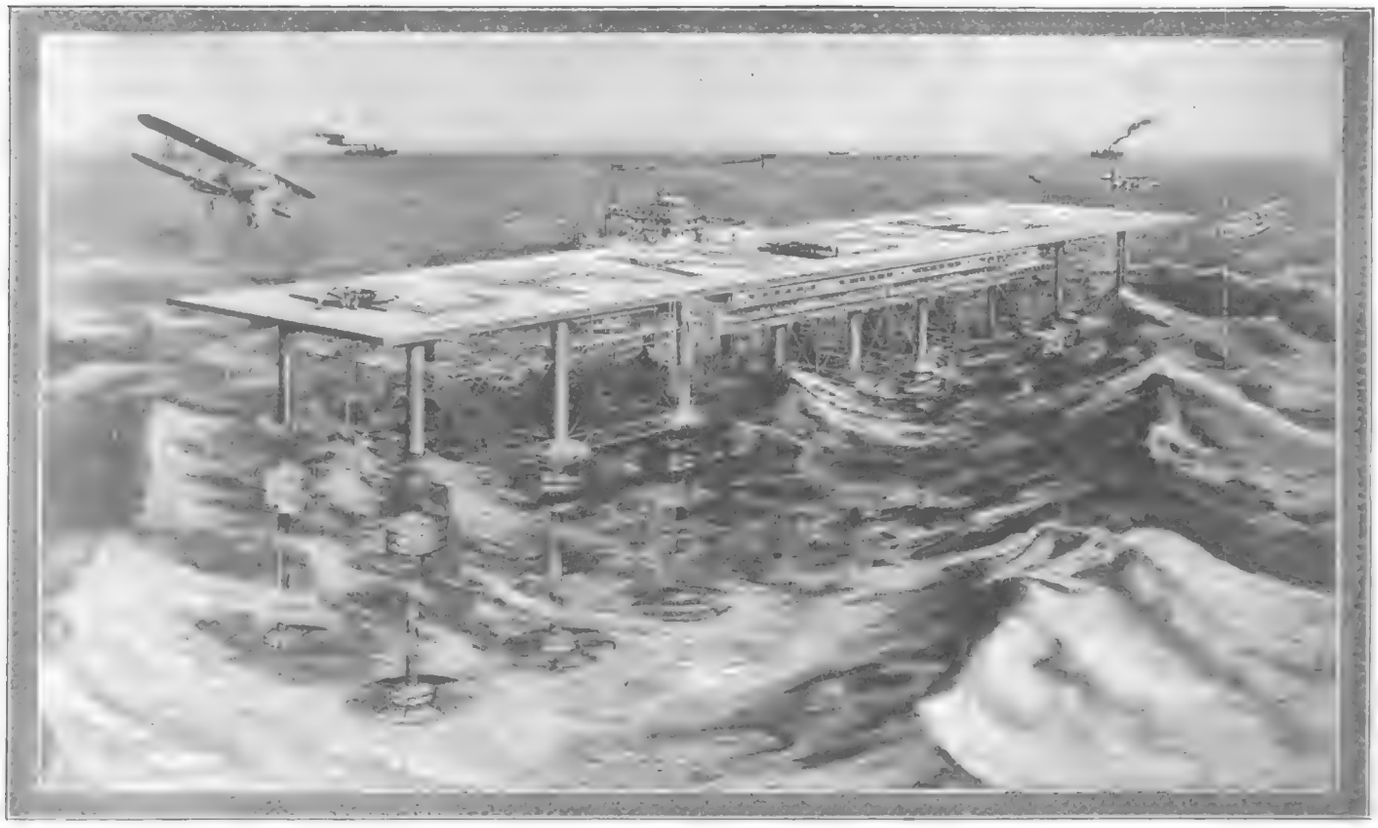
Then there is the matter of meteoric dust, which is thrown a number of times during the year, into the atmosphere. Every time a meteor strikes the upper regions of the atmosphere, the meteor becomes volatilized, acting in an analagous manner to volcanic dust. Swarms of meteors hit our atmosphere almost constantly, there being hardly an hour during the day when such bodies do not strike us, while at other times during the year, whole swarms pass through the upper air. It is very likely, however, that a mean value can be found for this meteoric dust, which will greatly facilitate long range weather forecast.

The far-reaching import of these researches can not be appraised too highly. From an economic standpoint alone their value is truly tremendous.

THE GOLDEN AGE OF SCIENCE

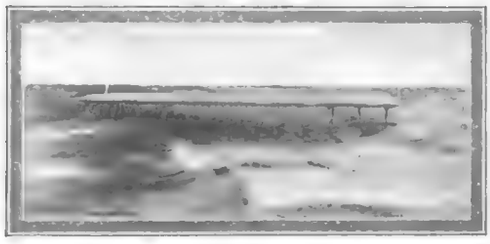
is symbolized by the golden cover OF SCIENCE & INVENTION LOOK FOR THE GOLD COVER every month!

Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various scientific and radio subjects.



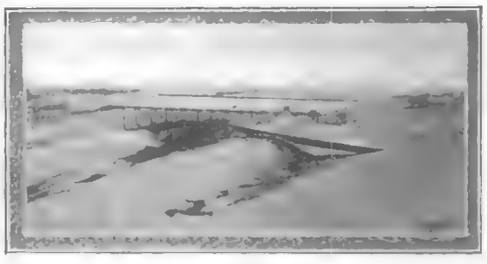
Above we behold one of the eight seadromes or airplane landing stations spaced 400 miles apart across the Atlantic Ocean, as proposed by a well-known American engineer, Mr. Edward R. Armstrong, of Wilmington, Delaware. These huge landing stages would be about eleven acres in extent, measuring 200 ft. by 840 ft. They would have deep draught, as great as 150 ft., so as to have their buoyancy chambers and legs below the wave depth.

Ocean Stations for Airplanes

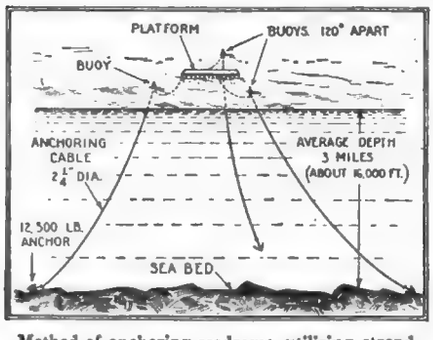


Photograph at left shows scale model of the Armstrong ocean landing stage under test in tank with waves 70 ft. high. Note that this remarkable design of platform preserves a practically level surface, while the waves break through it rather than against it.

Photo at right shows model of seadrome and also model of steamship "Majestic" under test in tank with 50 to 60 ft. waves; note that platform is practically level, while steamship "Majestic" is diving downward, practically overcome by the huge waves. The average height of ocean waves is 50 ft.

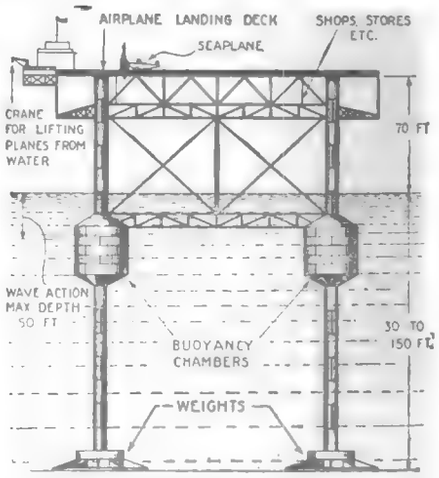


STARTLING as it may seem, a prominent American engineer, has actually worked out the technical details for an ocean landing platform or seadrome, on which Trans-Atlantic airplanes can land. One of the most interesting questions that arise in connection with such a project is that of anchoring the seadromes along the route across the ocean. Mr. Edward R. Armstrong of Wilmington, Del., chief research engineer for the famous Du Pont Powder Company, is the man responsible for this latest development in trans-oceanic air travel, and as the accompanying drawings show the platforms are to be anchored by three steel cables, extending down through three miles of water in some cases to 12,500 pound anchors. The platform can shift back and forth as waves and storms may dictate, and plenty of latitude is permitted due to the long cables. If the platform should move half a mile or more, it would make no difference to the airplane pilots.



Method of anchoring seadrome, utilizing stranded steel cables 2¼ inches in diameter.

As the picture on the opposite page shows, the seadromes would be marked at night by powerful colored searchlight beams, each station having its own particular color. Located fifty miles apart along the airplane route would be marker buoys, each buoy being illuminated automatically as darkness approached. The eight large seadromes, each measuring 200 ft. by 840 ft. and covering 11 acres, would be veritable floating hotels. Repair shops and storage space are provided for in the present designs of Mr. Armstrong, and radio as well as other signalling means are arranged for. Each station has its own name which is illuminated at night. The inventor has prepared tabulated data proving that this is the only feasible method for transporting passengers across the ocean for the principal technical reason that if no such sea stations are utilized, then the planes can only carry about four passengers, the balance of their carrying capacity being occupied by fuel; the same airplane using Mr. Armstrong's scheme can carry forty passengers. Based on 100,000 passengers per year, the annual difference in cost in favor of the sea station route is $14,080,000. Mr. Armstrong's scheme calls for 24 planes total, while without sea stations 240 planes are required.



End view of seadrome. The buoyancy chambers can be placed below the wave action depth.

How Airplanes May Skip Across Ocean

THE realistic night scene above shows two of the Armstrong seadromes or landing stations for airplanes, as they wing their way across the Atlantic from America to England. Each station would have its own colored searchlights, enabling the pilots to distinguish each station if necessary. Located 50 miles apart along the aerial route are illuminated buoys anchored in position by cables and anchors. The large plane shown above has a capacity of 40 passengers and luggage and carries signal as well as landing lights. Hotel accommodations are provided on each platform for those desiring to stay over night. Owing to the clever design of these landing platforms, the waves break through them rather than against them. The buoyancy chambers supporting the platform are placed deep enough to escape the wave action, extending about fifty feet maximum.

The Dream Recorder

By HUGO GERNSBACK

The dream-recording machine attached to the sleeper, who is under observation. The dream, in changing the heart beat, makes its presence known immediately. If the sleeper sleeps peacefully, without dreams, the heart action is normal. See Fig. 2.

"WELL, how did you sleep last night?" says your host, as he pats you on the back.

"Fairly well," you retort, "But that Welsh Rarebit gave me such a beastly nightmare I couldn't go to sleep again for a few hours."

This is the sort of conversation we hear very frequently, but we laugh it off, and the world moves on.

Few people, if any, ever give a thought to the *reason* for our dreaming. From ancient times on, dreams have been looked upon with great superstition, and even today dream books are consulted for an interpretation of this or that dream. The mechanics of the dream itself, from the psychical viewpoint, have been studied by many philosophers and scientists, but few, if any, ever gave any thought to the primary cause of dreaming.

PRIMARY CAUSE OF DREAMS

It may be said that 90 per cent. of our dreams lead right back to our stomachs. That this has not been recognized more widely has always been a mystery to me. It is, therefore, not the brain that is primarily responsible for dreams, but, rather, the stomach. If you go to sleep with a comparatively empty stomach, that is to say, after your food has been digested, and has left the stomach, the chances are that you will have a good night's sleep and that you will not dream at all. Of course there are exceptions to this, as to anything else, but in the great majority of cases you will find that this is the truth.

When you have slept "like a top," it simply means that you have not dreamt. The person who sleeps best, and is most refreshed by sleep, is that person who does not dream. The term "pleasant dreams" should be abolished, as soon as possible. There is no such thing, in my opinion, as a "pleasant" dream. *All dreams, whether pleasant or unpleasant, interfere with your rest,* and if you do need the rest and do wish to wake up refreshed in the morning, then it is best to stop dreaming.

This seems a rash statement, but the point is that it is possible to prevent dreams, if dreams are harmful, as I shall show. Most foods take anywhere from two to six hours to digest. Some foods take even longer than this. The table reproduced herewith shows this clearly. Due to means not exactly understood today, there is an unusual nervous reaction between the stomach and the brain, while we are asleep, so that a full stomach with slow-digesting food causes constant dreaming, often of the nightmare kind.

My own theory is that the process is somewhat as follows: The minute you lie down and sleep, and the stomach is still working while digesting its food, the gases usually thus developed, press against the heart, causing an oppressed feeling, which is then, by nervous reaction, reflected to the brain, thereby inducing harmful dreaming.

FATAL DREAMS

This kind of dream is distinctly dangerous, often even fatal. A great many people die in their sleep. For instance, Mr. William Jennings Bryan died in such a sleep. It is quite probable that sleepers of this kind meet their death directly due to nightmares, or other fear-inducing dreams. For example, if, during a nightmare, as happens to all of us, we fly through space, or fall down a precipice, we usually wake up all covered with perspiration, and the heart beating violently. If the heart is sound, no

DIGESTION OF DIFFERENT FOODS IN STOMACH

These foods leave the stomach in two to three hours:

Boiled Milk, Eggs, raw, poached, or omelet; Beef Sausage, Sweetbreads, Oysters, Whitefish, Shellfish, Asparagus, White Bread, Rusks, and Biscuit.

These foods leave the stomach in three to four hours:

Chicken, Lean Beef, Boiled Ham, Roast Veal, Beefsteak, Salted Caviar, Coarse Bread, Boiled Rice, Boiled Cabbage.

These foods leave the stomach in four to five hours:

Smoked Tongue, Smoked Beef, Roast Goose, Salt Herring, Lentil Porridge, Pease Porridge.

An ordinary dinner leaves the stomach in four to five hours. Foods are divided into four groups, according to the ease with which they are digested. The first group contains the most easily digested foods:

(1) Beef Tea, Milk, Soft or Raw Eggs, Biscuit.

(2) Boiled Calves' Brains, Sweetbread, Boiled Fowl, Pigeon, Calves' Feet.

(3) Scraped, underdone Steak, Potato Puree, Stale Bread.

(4) Roast Chicken or Pigeon, Roast Veal, Cold Roast Beef, underdone, Whitefish, Macaroni, Rice, Chopped Spinach.

NOTE: There are exceptions to all of these, because food is digested more quickly by working men who consume energy than by those who sit still or lie down.

damage results, but if the heart is defective, often a heart stroke or the bursting of blood vessels occurs, with the immediate death of the victim. *Any one with a weak heart, therefore, should never indulge in heavy food before going to sleep,* whether it be an afternoon nap, or the night sleep. If he does, a fatality may result, directly due to a dream.

Even the most pleasant dreams, which have nothing to do with the digestive organs, affect the heart action. You may sleep with a totally empty stomach and still have a dream. In that case it probably never is a fear-inspiring or nightmare type. It is of the variety termed a "pleasant dream." A dream may be induced in a sleeper by scent, or perfume, by a slight noise in the room, by touching the sleeper's body at any point, by a change of temperature, by a change of barometric pressure, by a nervous shock during the day, and a thousand and one other means. Such dreams are of a very short duration, as a rule, and do not greatly interfere with the sleep itself, although I maintain that it is best not to dream at all.

IF YOU DREAM—SEE YOUR DOCTOR

For that reason, if you are inclined to dream much, you should consult a physician and re-arrange your diet in such a manner that through the experience which you will shortly gain you will dream less and less. You will have to experiment on yourself, as no two individuals are the same. Some people find that they sleep much better by drinking a glass of hot water or milk before retiring, or some other harmless liquid. All of this will have to be experimented with until you find the correct formula.

The sleeper's position in bed is also most important. Some people dream excessively when sleeping on their left side. This is but natural, because the heart, under compression, gives rise, very often, to fear complexes, especially in nervous and excitable people. It becomes then a matter of training to sleep on the right side or in such a position that no dreaming is induced. This is a matter of experience also, and here a little self-hypnosis often does wonders. If you are inclined to sleep on your left side, and if you know this induces bad dreams, all you have to do, before retiring, is to keep on repeating, *with as much will and concentration as you can muster,* that you will positively not sleep on your left side that night, and keep on repeating this in the well-known Coué form, nightly for several weeks. You will find that by willing strongly enough, you can cure yourself from sleeping in any position that you do not wish to assume.

ACTUAL DREAM RECORDS

In order to test what has been said before, I decided to make actual tests upon sleepers, and the illustrations here show the results of these tests. Recourse was had to a heart and pulse testing machine, known as the "Polygraph." The Polygraph is a very sensitive instrument, which, when strapped over the heart or on the wrist, will give an exact record of the heart beat. The instrument is exceedingly sensitive and records not only the breathing, but the heart action as well.

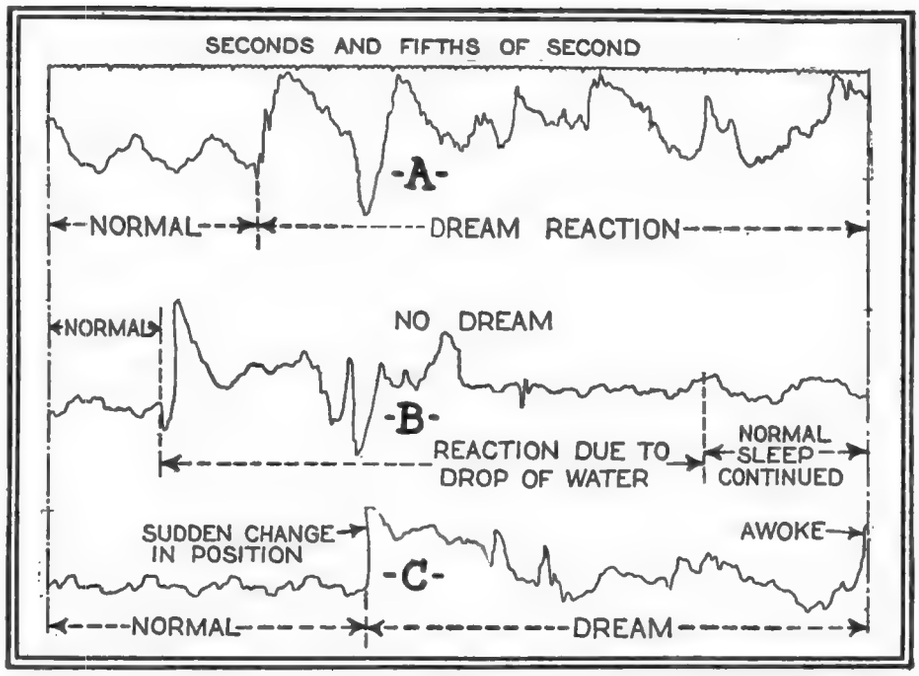


Fig. 2. Actual records of dreams taken with the Polygraph. Note the dream reactions, which increase heart fluctuations above the normal.

In order not to go into any great technicalities, it may be said here that a great number of records were made in our laboratories, and my theory that dreams could actually be recorded is now a fact. While the technique of dream recording has not been carried to a logical conclusion, I wish to state here that whatever results we had in the laboratories were very encouraging, and I hope that much good will come from the future recording of such dream actions. I believe that in due time physicians will find it necessary to record the dream actions of their patients if they dream too much, which consequently interferes with their health.

At this point I also wish to explode an old theory that dreams are of a very short duration. We actually found the reverse true, at least the polygraph recording the heart action, showed that a dream lasts at least a number of seconds, and not fractions.

It is obvious, from the records obtained in our laboratories, that during the process of dreaming, the heart action is materially stimulated, and respiration is also accordingly increased. All of the cases which came under our observation produced the same effect, when a dream actually occurred.

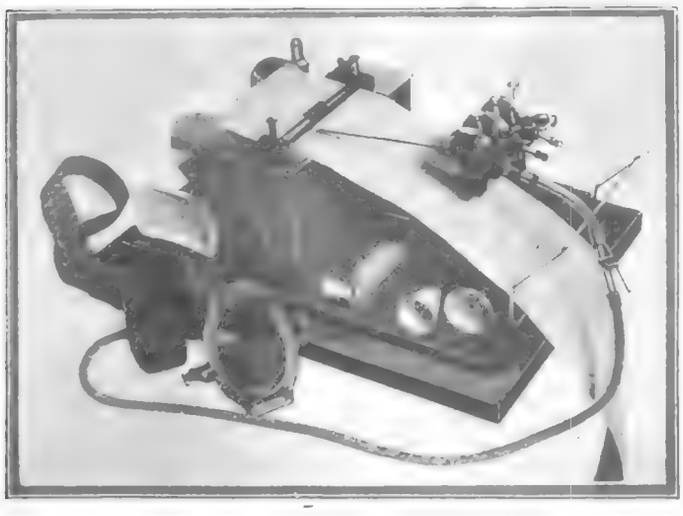
The tests not having been carried on over an extended period, we had no chance to observe a *nightmare* or startling dream, but it is quite apparent from our records that if there had been such the resulting action would have been greatly increased. In our illustration, Fig. 2, we show actual records taken by the polygraph.

In case "A" it will be observed that the apex beat increases almost instantly to four times the normal sleeping rate. In "B" and "C" on our graph it becomes difficult to actually note the apex beat because of the influence which breathing has upon the heart record.

The gradual undulations of the curves in the normal record are produced by the process of inhaling and exhaling. The inspiration in all of the cases is much greater under the excited reaction of a dream than in the normal sleeping state. Notice also that the respiration is changed when the subject changes his or her position during sleep, and you will also see that when dreaming, in case "C" the heart rate was stimulated immediately after the change of position.

In "C" an electric bell was used to awaken the subject, being rung softly at first and then permitting the bell to remain quiet until the subject again assumed normal respiration and heart curves, and then the tone was increased until the subject eventually awoke. Although a slight disturbance took place every time, it was not as marked as just before awakening, at which time this patient recalled a dream of an alarm clock awakening her and summoning her to work.

It is obvious from records which have been obtained that dreams do affect not only respiration but also the heart beat, and that the dreams of some subjects stimulate the heart to a greater extent than those of another. It is believed that this is the first attempt made to record heart action during sleep, laying particular stress on the heart action of subjects who dream a lot. The experiments have not yet developed to a point where a record was taken during a nightmare or one taken of an individual who frequently walks in his sleep.



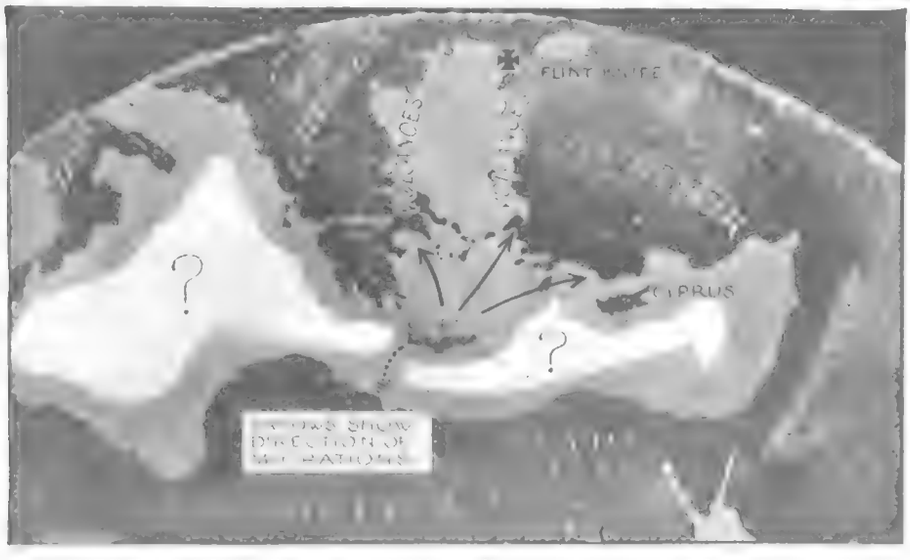
The Polygraph Recorder — primarily built to record the heart and pulse actions, and used here for the first time to record dreams.
Photo, courtesy of E. Leitz, Inc.

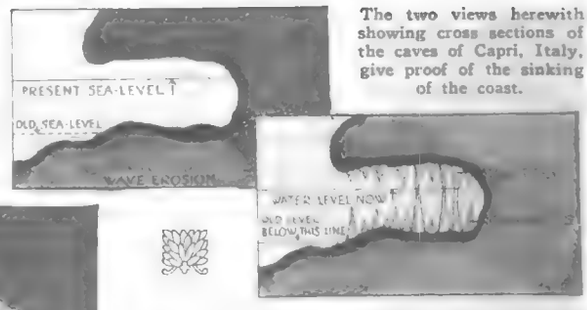
The most gigantic and terrifying cataclysm ever witnessed by man was probably that which took place when the Aegean Continent subsided so that water completely covered everything except the highest mountains. As the picture above shows, the onrushing tidal wave swept everything before it. Earthquakes caused giant cracks to open in the face of the earth, while volcanoes belched forth smoke, rocks and boiling lava. Imagine such a catastrophe occurring today, especially in the vicinity of our larger seaports like New York City or San Francisco.

The World's Greatest Cataclysm

By PROF. DONALD H. MENZEL, PH. D.
(Department of Astronomy, Ohio State University)

THE most gigantic cataclysm ever witnessed by man doubtless occurred when the Aegean Continent subsided, as the picture above shows, and as the map drawing below and on the opposite page also illustrates. The time of this cataclysm is comparatively recent, contrasted to the millions of years that constitute every geological period. This subsidence occurred since the last glacial epoch. A flint knife discovered in deposits laid down before the catastrophe, proves that man was present. Cross in map below shows where flint knife was found. The contour in depth-map below shows what the general shape of the continent was.

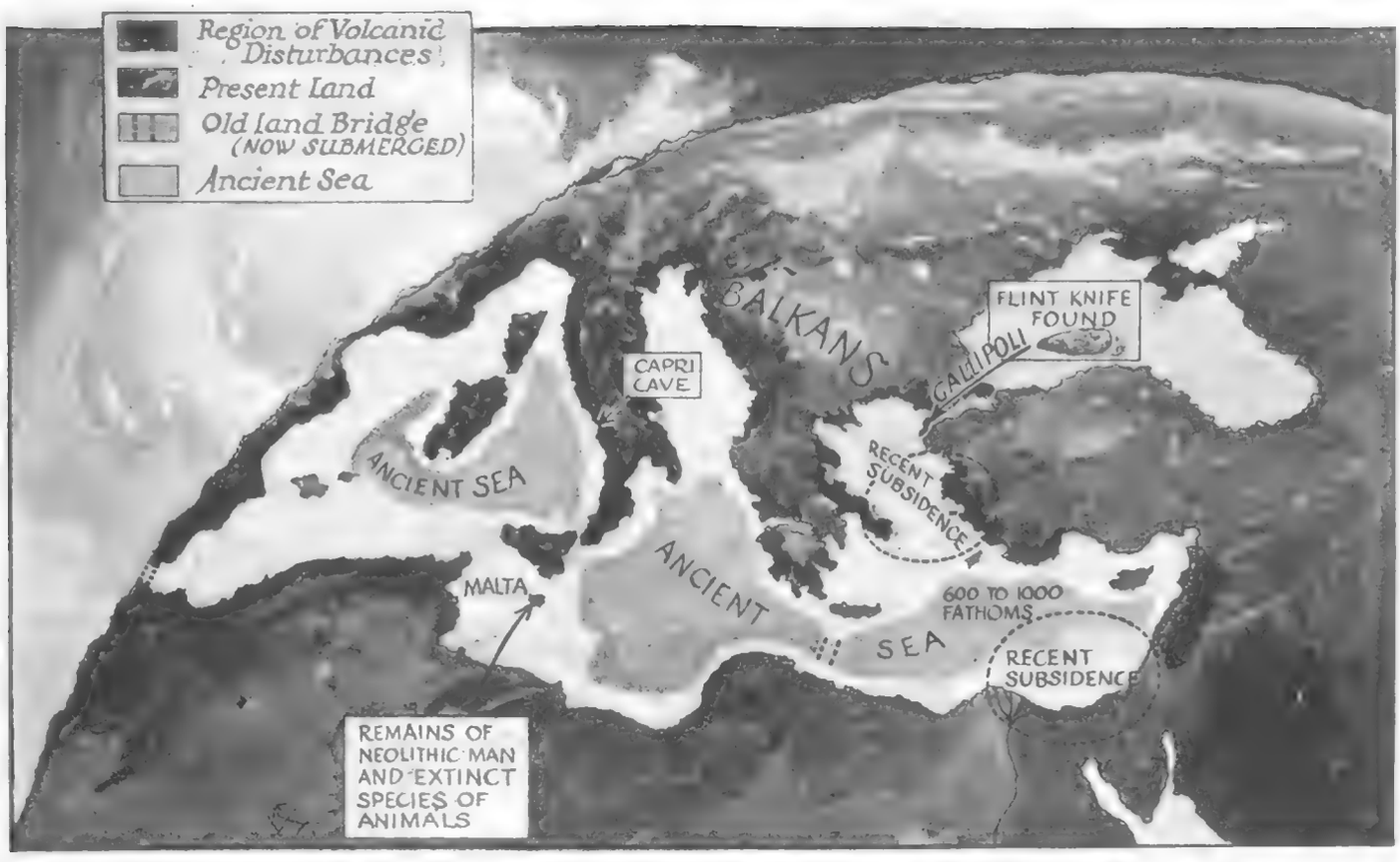


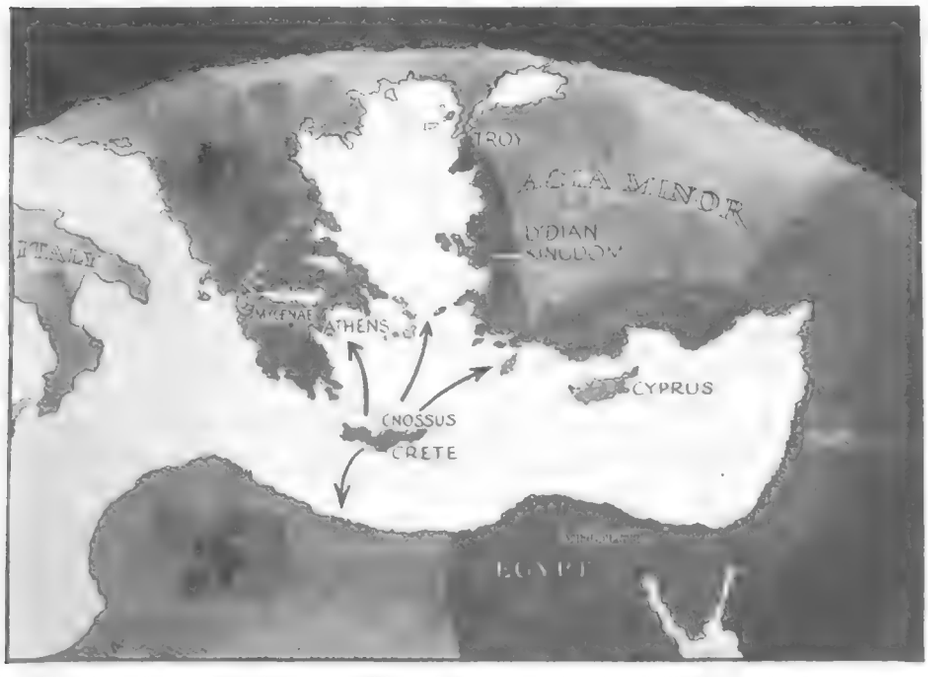


The two views herewith showing cross sections of the caves of Capri, Italy, give proof of the sinking of the coast.

While the original subsidence was probably quite rapid, accompanied by floods, earthquakes, and volcanic eruptions which would destroy all life in the basin, it is interesting that it is still slowly continuing in spots.

The two pictures above show the effect of the subsidence in the caves of Capri, Italy. The formations known as stalactites and stalagmites take place only in air. The fact that we find them submerged in caves proves that the water level has risen considerably since they were made. The unsettled condition of this region is further evidenced by the number of active and extinct volcanoes which surround the Aegean. It is not a coincidence that the three great prehistoric civilizations surround the vanished continent. From the similarity of their arts the parent race apparently was scattered in all directions.



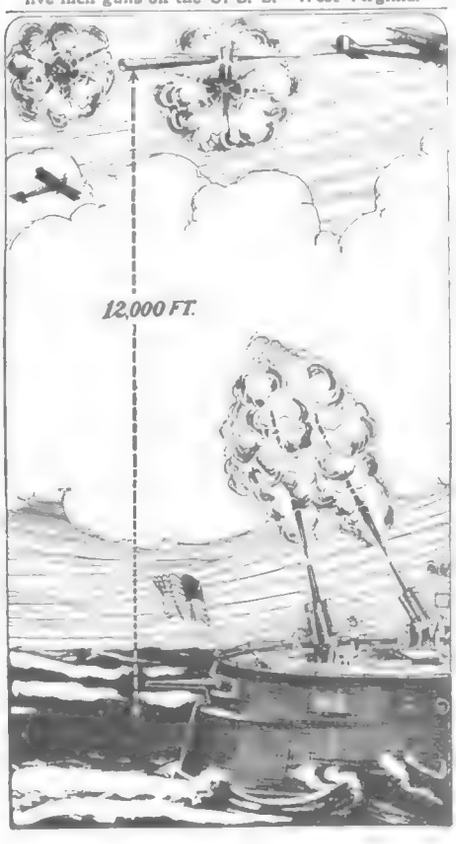


The physical map above shows the positions of the centers of ancient civilization at the time of the great flood, caused by the subsidence of the Aegean Continent. It is thought, due to the similarity of their arts and legends, that the parent race was scattered as arrows show.

THE maps at left and above show centers of ancient civilization. It seems from a study of the subject that the parent race living in the center of the continent was scattered in all directions by the catastrophe. The origin of the flood-myth common to many peoples, the cradle of civilization and the source of language and art, by this theory, rest at the bottom of the sea. The location of the ancient seas and the land bridge to Africa are shown clearly on the map.

Air Bombers Beware

In recent aerial target practice sleeve targets were shot down from a height of 12,000 feet by five inch guns on the U. S. S. "West Virginia."



Grass-Growing By Electricity

EXPERIMENTS in the use of electric light at night for promoting the rapid growth of grass have been tried under outdoor conditions on the Jumping Brook Golf Club's course in New Jersey. A clay gravel site was dug, and the top soil from another portion of the land used to provide about fifteen inches of soil for the green, which was sown early in June, and over a portion of it were erected 24 special reflectors, each containing a 1,000-watt tungsten bulb. The reflectors were hung four feet from the ground and gave a continuous even light. The light was switched on on June 6th, and for the next 21 nights. The weather was unfavorable to the rapid germination of grass seed, but the first seed came through under the electric light five days after planting. Nothing came through on the unlighted portion of the green until two days later. At the end of three weeks the grass under the electric light had attained a general growth of nearly four inches, while on the portion of the green outside the lamps there was a growth of about one inch. This system saves at least 40 per cent. in the time between planting and cutting the average green, and after cutting it thickens the growth.

Hunting Whales with Airplanes

By H. WINFIELD SECOR

Fig. 1 shows latest method of hunting whales. Plane spots whales and radios the news back to mother boat equipped with harpoon gun.

Fig. 2 above shows scheme for killing whale with explosive bomb dropped from airplane. Whale floats shortly after being killed.

Fig. 3 at left shows how airplane can use depth bomb on whale, which is visible at considerable depth. Whale would rise to surface afterward.

THE very latest news in the science of hunting whales is to the effect that Captain George L. Marquand, manager of a whaling company of Victoria, B. C., has chartered an airplane for each whaling venture. The airplanes will be used it seems mostly for spotting the whales, when the pilot will radio back to the whaling vessel equipped with harpoon guns as to the whereabouts of the whale or whales. Other possibilities of the airplane in hunting whales are shown in the accompanying pictures. As whales when killed putrefy very rapidly, due to the large amount of gas developed, they would rise to the surface even if killed with explosive bombs from an airplane or by a depth bomb, as shown in Fig. 3. A better scheme perhaps is that shown in Figs. 4 and 5 where an inflatable rubber bag is fitted to the harpoon shot from an airplane. With several of these fastened to the whale, he will eventually be tired out and the bags also serve as markers.

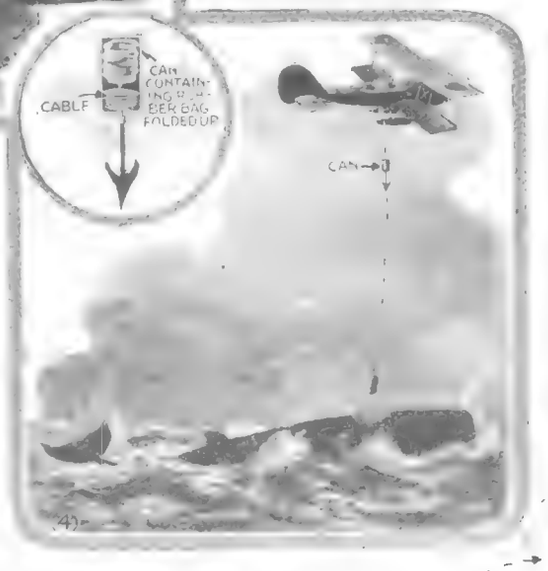


Fig. 4 shows scheme employing inflatable bag and harpoon dropped from airplane on whale.

Fig. 5 shows bags inflated to tire out whale and give vessel chance to capture him.

SOME ODD FACTS CONCERNING WHALES

On most Cetaceans (whales) traces of the hairy covering of ordinary mammals are present, showing in a few short, scattered hairs on certain parts of the head. The forelimbs, (represented by the fins, or "flippers") are like those of other mammals in structural characters; they are used as balancing organs. The hind limbs are never to be seen externally, and are present only as small vestigal bones (see the skeleton of the Dolphin).

The tail ("flukes") is horizontal, and not vertical as in fishes; it is probably used as the sole means of propelling the animal. The dorsal fin is totally absent in some Cetaceans, but in others, the dreaded killer for example, grows to a great height. Unlike fishes there are no bones in the back fin or tail. Between the smooth skin and the flesh the entire body is covered by a thick layer of fat or "blubber," which prevents the loss of animal heat (it is from the blubber that the oil is "tried out.") The nostrils, or "blowholes," which may be either single or double, open from the top of the head, save in the sperm whale. When a whale comes to the surface to breathe, it at once expels the air from its lungs. This warm air is saturated with water-vapor, and, when it is discharged, condenses; thus a column of steam or spray is formed, which is forced to a considerable height (20 feet or more). It is this spray which gives rise to the common belief that the whale actually spouts water. Cetaceans are found in all the oceans from near the Antarctic regions to within the Arctic Circle. Many of the smaller forms (porpoises and dolphins) ascend rivers for a considerable distance, and all the members of one family are exclusively inhabitants of fresh water.

The whales of the world may be divided into two great classes, viz:

1. Whales without teeth.
2. Whales with teeth.

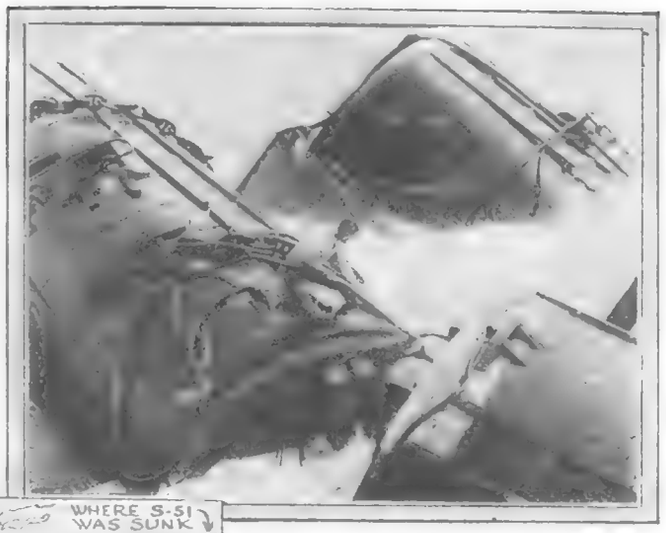
Those of the first group (the toothless whales) are all characterized by plates of so-called "whalebone," or baleen, hanging from the roof of the mouth. The plates are of use in straining from the water the often almost microscopic animals upon which these whales feed. Whalebone varies greatly in length in different species. Whalebone was of considerable commercial value, the better grades at one time being worth from six to eight dollars per pound. The blue or sulphur bottom whale, a life size model of which hangs from the ceiling of the museum, the Finback and the Right whale are representatives of the toothless or whalebone whales. The

(*Continued on page* 476)

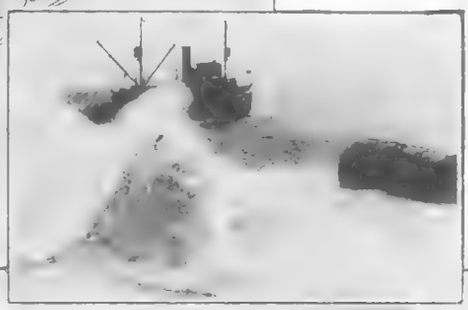
S-51 Finally Raised

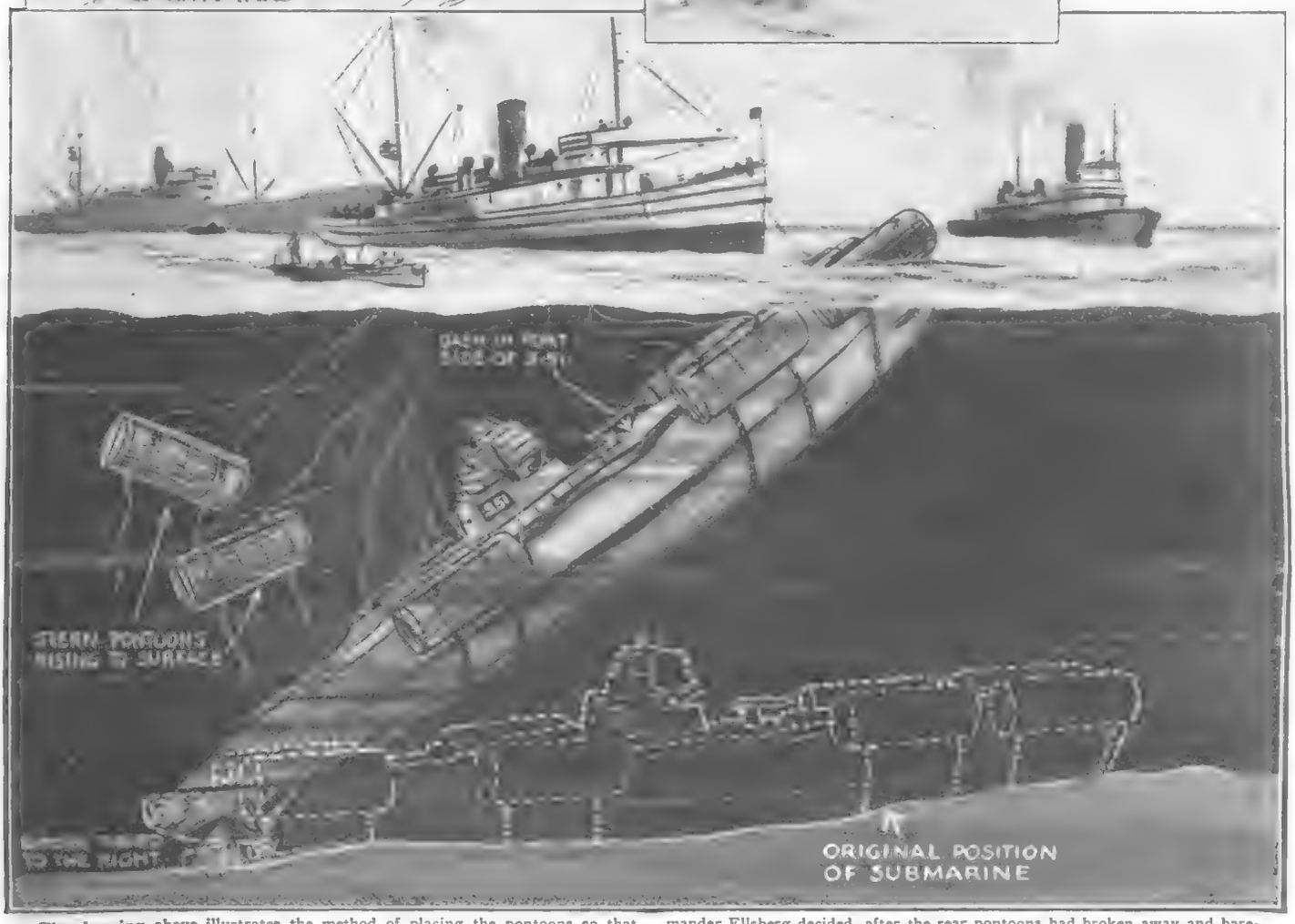
Grounds on Way to Navy Yard

THE ill-fated submarine S-51, sunk after a collision with the S. S. "City of Rome," off Block Island, has at last returned to her home port after having appeared to be hopelessly jinxed. The first attempt to raise her from her resting-place 150 feet below the surface resulted in failure when the chains connecting the rear pontoons parted. Their breaking-away threw an additional load of 150 tons on the other pontoons, and it was found necessary to permit the S-51 to sink again so that a new "bite" might be taken. The specially-equipped "Falcon," under the command of Commander E. Ellsberg, recompressed air from the air-banks of the submarine S-50, which stood-by near at hand, and pumped it to the lifting pontoons which finally succeeded in raising the sub to the surface. In towing the S-51 to the Navy Yard she was grounded for a time on Man O' War Reef in the East River, but the next day she was placed in dry-deck.



The bow of the S-51 can be seen between the forward pontoons in the above photo of the first salvage attempt. The figure on the near pontoon is one of the courageous divers who risked their lives to keep the hose-lines from fouling. At the left is a chart of the route followed by the salvage party, showing where the S-51 grounded after having passed what were considered the most hazardous points. The photo at the left gives an idea of the risk entailed in the work of salvage. Here one of the rear pontoons is crashing upward after breaking away.



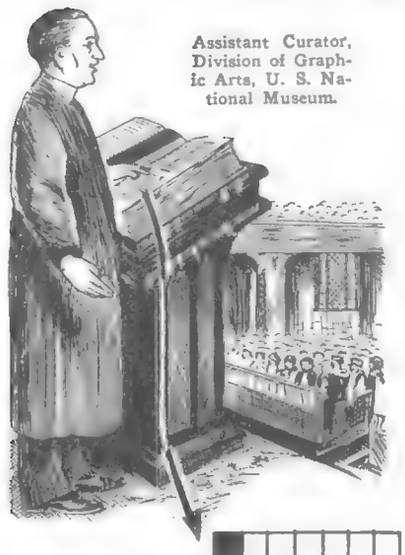


The drawing above illustrates the method of placing the pontoons so that they would exert the greatest possible lifting power on the wreck. Commander Ellsberg decided, after the rear pontoons had broken away and barely missed a surf-boat in rising, that the sub should be lowered again.

Microscopic Engraving

Lord's Prayer Engraved on Pin Head

By R. P. TOLMAN



Assistant Curator, Division of Graphic Arts, U. S. National Museum.

The micro-engraving of the Lord's prayer below was made in 1/781,250th square inch. The entire bible engraved on this scale would occupy but 1/49th square inch.

THE first micro-engraving that I ever read (I had seen others with the naked eye, but nothing but glass was visible) was one which was sent to me in the form of a letter, it was clearly seen through the eye of a needle. But before it could be read it was necessary to enlarge it 85 times by a high power microscope. This micro-engraving covered about 1/11250 of a square inch. The reproduction is enlarged about 70,000 times. This had been prepared by Alfred McEwen of New York City, for a Regents meeting of the Smithsonian Institution where it created much interest. It reads in part: "This is a crude, hurriedly prepared large sample of 'Micro-engraving.' The writing was done with pencil on a 4x7-inch tablet. One a little larger (Fig. 1), is one one-hundredth of an inch in diameter; the ruled lines are less than 1/1,000th of an inch apart; this illustration measures about 4¼ inches and if it was exactly 4¼ inches in diameter, it would contain 12.3518 square inches; and if it were possible to engrave all over a sheet of glass that big, this same letter with its illustration would have to be repeated 123,518 times to cover it.

The micro-engraving shown at right was done in 1/100 inch circle.

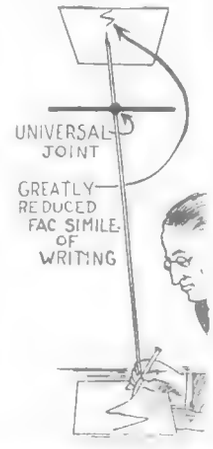
When we are confronted with statements like this we are all liable to use a little word of four letters. Before this article is finished you will probably want to use this little word several times, but every statement is fact.

Just one more illustration, before I tell you how these infinitesimal engravings are made. The Lord's Prayer is commonly used in things of this kind, for example, it has been engraved on the head of a large pin, and it has been cast on a typed body, one-sixth of an inch square and in micro-engraving it has been used extensively. Mr. McEwen sent one of his smallest engravings of the Lord's Prayer to the Bureau of Standards, Washington, D. C., to be measured. Their report gave the dimensions as 0.0016 of an inch by 0.0008 of an inch high.

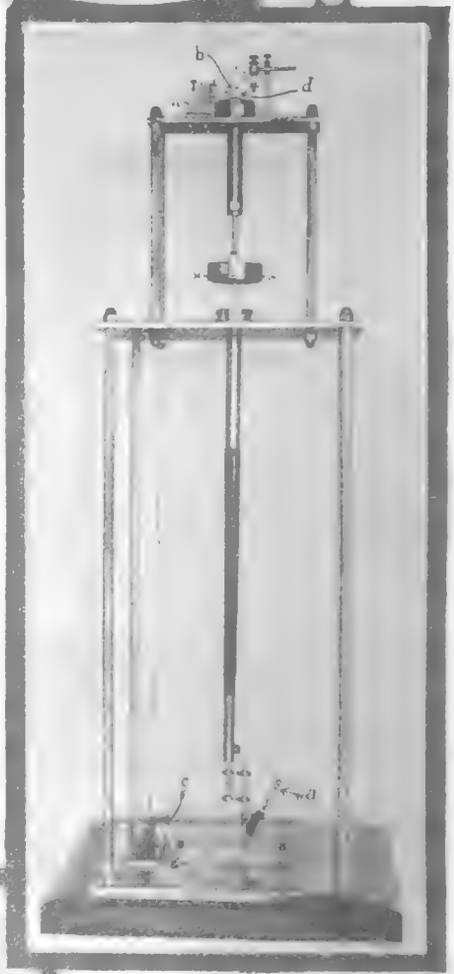
Now if you will multiply these figures you will find that one Lord's Prayer of this size will cover only 1/781,250th of a square inch, in other words the 227 letters in this prayer would have to be engraved 781,250 times to completely cover one square inch.

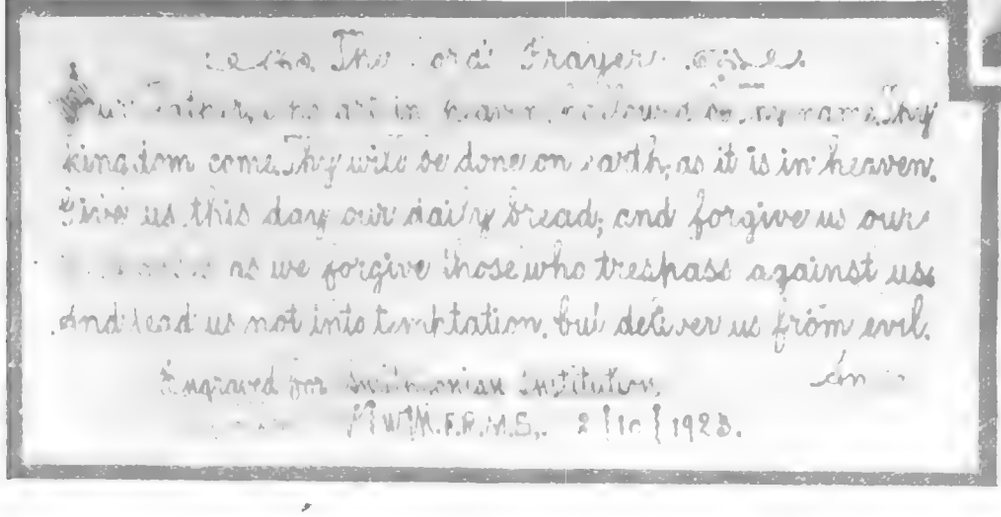
I don't blame you for shaking your head. Fig. 2 is a reproduction of this micro-engraving, it is not as clear as the larger ones, but it can be read. The distance between the top of the top line and the bottom of the last or seventh line is 1/1,250th of an inch. The paper on which this article is printed is about 1/400th of an inch thick, therefore the seven lines of this engraving could be repeated three times in a space equal to the thickness of one page of this magazine. It does not seem possible. To carry this comparison along a little farther. The fifty-six words of the Lord's Prayer contain 227 letters and on this scale 177,343,750 letters could

(*Continued on page* 450)



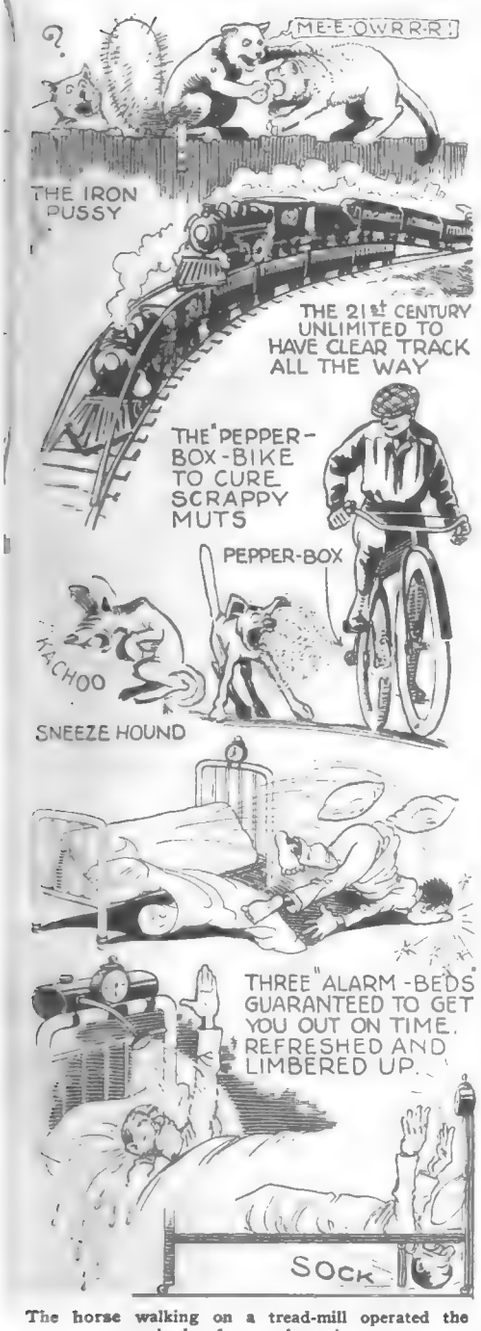
The diagram at the right shows in simplified fashion how micro-engravings are made. The person doing the writing takes the pencil in hand and writes out in ordinary sized letters the sentence or other material to be engraved in a fraction of a square inch. As will be seen at once the short length of the upper arm with respect to the greater length of the lower arm, causes the handwriting to be markedly reduced in size. The micro-engraving is done by means of a highly polished diamond point made with the finest precision.





Odd and Unusual Patents

By STUART WALKER


ME-E-OWRR-R!
THE IRON PUSSY
THE 21st CENTURY UNLIMITED TO HAVE CLEAR TRACK ALL THE WAY
THE "PEPPER-BOX-BIKE TO CURE SCRAPPY MUTS
PEPPER-BOX
KACHOO
SNEEZE HOUND
THREE "ALARM-BEDS GUARANTEED TO GET YOU OUT ON TIME. REFRESHED AND LIMBERED UP.
SOCK

The horse walking on a tread-mill operated the wheels of an early train.

OUR civilization rests heavily upon the shoulders of the inventor. But for the man of new ideas we should now be living in huts and caves, wearing skins for clothing, and stalking about with a club in search of food. Fortunately for the world inventors are very numerous. The records at the United States Patent Office at Washington bear out this fact. Since the issuance of the first patent to Samuel Hopkins on July 31, 1790, for a process of manufacturing potash and pearl-ash, the Patent Office has granted more than a million and a half Letters Patents. Among them are the inventions which have changed the course of history, which have brought about our civilization of today—the internal combustion engine, the cotton gin, the locomotive, the telegraph, the telephone, the airplane, the radio, and thousands of others.

However, the Patent Office records also reveal many utterly useless patents, all undoubtedly intended to be of great service to mankind, but some are actually worthless, some grotesque, some ridiculous, and many are merely huge jokes. The scope of these "freak" patents extends far beyond the bounds of practical imagination.

No one who has been awakened from a sound sleep by the exasperating yowls of a cat can fail to recognize the fine intentions of the man who patented a "mechanical sheet-iron cat with cylindrical attachment and steel claws and teeth, worked by clockwork, having a bellows inside which inflated the tail at will to an astonishing size and, by a tremolo attachment, causes at the same time the sheet-iron cat to emit the noises of a living one." When you are bothered by felines, just put the sheet-iron pussy out on the back fence. Every cat that hears him will come out to fight. No sooner is the sheet-iron cat touched than his claws and teeth begin to work with startling rapidity. The other cats are torn and put to flight, but the mechanical cat remains uninjured. In this case the inventor had, at least, a commendable intention, and it is strange that his efficient kitty did not become more popular.

Those who spend time in worrying over the terrible congestion in all our large cities because of the great increase in motor vehicles may find suggestion of relief in the patent of a man from Wickes, Montana, which covers "a means for fast trains passing slow trains on the same track." This may sound highly imaginative, but the inventor proceeds to show what a simple and safe proposition it is. The patent provides for trains having rails along the tops of the cars and carriages, and inclined structures bearing rails at each end of the train. The fast train, upon overtaking the slow train, is merely supposed to run up the rear incline, along the top of the train, down the front incline, and on its way. It is a very simple matter indeed.

(*Continued on page* 469)

ETIQUETTE DEMANDS THAT YOU SALUTE YOUR ACQUAINTANCES, YOU CANNOT CLAIM TO BE WELL BRED UNLESS YOU WEAR ONE OF THESE "AUTOMATIC SELF-TIPPING HATS" ETC. ETC.

THAT SUPERB FEELING OF BEING DRESSED FOR THE OCCASION, AND AS DRY AS THE 18th. AMENDMENT

THE MOST CHICKEN-HEARTED PERSON CAN NOW PERFORM A MAJOR-OPERATION ON THE OLD RED ROOSTER.
THE FRENCH REVOLUTION
THE PLYMOUTH ROCK

Freak form of locomotion mimicking walking movements.

Our Spiritualistic Investigations

By Dunninger.

"One after the other, in quick succession, things were told the gathering. Messages began to come, the words issuing from behind clinched teeth. . . ."

SEVERAL weeks ago during conversation with a very dear friend of mine, who by the way had been a fellow student of spiritualism and kindred subjects, he informed me that he had on two occasions witnessed a séance by an unknown medium whose offering was little short of miraculous.

"Yes, Dunninger, this woman is an enigma. Often I have witnessed similar things but never in my numerous experiences has anything impressed me as so unusual. Miss Thelma Mason is unusual in a way that would ordinarily be accepted as a standard of unusual intelligence."

"In what way unusual?" I asked.

"Why this woman is no faker, I tell you Dunninger," said my friend Lustig. "She is uncanny; not alone does she bring apparent messages of those about her, but she actually described the likeness of my dead uncle Maxwell. Told me how long since he had departed and presented details of the illness that carried him off. Of course, I don't believe this stuff any more than you do, but I am frank to admit that she has me guessing. Would that you could hear those who were present with me speak of her seemingly marvelous readings . . . they are fully convinced that she is supernatural.

"She actually calls the departed by names and tells the sitters things that actually makes the color leave their faces . . . they sit astounded . . . amazed!

"How does she do it? What is her method? I scoffed at what was told me of this woman. Finally I attended one of her séances and I too was amazed. Now, Dunninger, you must pay this woman a visit and see for yourself just what really transpires."

"Good," said I. "There is no time like the present," as I looked at my time-piece. "It is just five minutes past seven. Let us hail a cab and be on our way."

"Yes," said my friend, "that is all very well, but these séances are not entirely public and arrangements must be made beforehand."

'Phone in hand my friend was soon informed that the next meeting would be held on the following evening. An appointment was made.

Arriving at the house, located in a side street east of Broadway, we were ushered into a reception room. The room was plainly furnished. The only pieces of furniture were several plain chairs and a small table. A quick examination proved that these articles were of the most ordinary type. No trickery there.

A number of pictures adorned the walls each of a religious character. These pictures were of the cheap lithographed type set in frames of the cheapest sort.

Here we were ready to witness the seemingly marvelous séances. Several "customers" were present. Several were of the aged type familiar at such séances. One old lady was there for the second time that week, she having attended the séances at least twice every week.

This old lady was in deep conversation with several others . . . unfolding the wonders accomplished by this medium.

Listening to that sort of talk tired us, but suddenly into the room walked a maid. She was partly Chinese and partly French. A clever talker and with ideas that seemed to end when we switched from the borderland to more prosaic chatter.

Unfolding a tale of a noted Chinese medium this little lady had me thinking what wonderful ideas she would have for unworkable illusions for stage work.

The maid next greeted several of the parties present; calling them by name and talking intimate bits of business.

"What is the charge for attending these séances?" I asked one of the bystanders.

(*Continued on page* 463)

$21,000.00 for Spirits

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent? Should we not consider every psychical manifestation as being trickery pure and simple, intended primarily to fleece those who visit the circle and who find solace in the words from the worst forms of charlatans, namely those who are being permitted to practise upon the poor, seeking words from loved ones?

To the $10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine, we now add another $10,000.00.

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

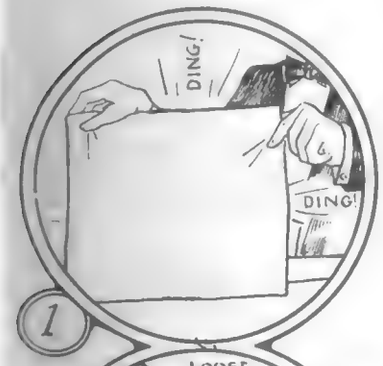
So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

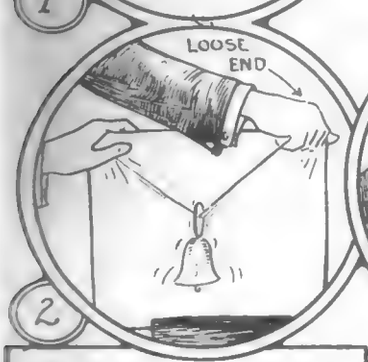
Spirit Tricks

By WALTER B. GIBSON

The Following Tricks are Duplicates of the Stunts Used by Fraudulent Mediums, and can be Performed Perfectly With Very Little Practice.

A handkerchief is held in front of a bell in the manner indicated in the diagram below. The bell rings almost immediaely after the handkerchief is raised to the position shown. When the cloth is withdrawn the bell may be examined. The method is made clear in illustration 2, below.



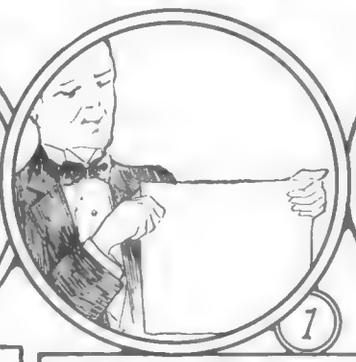


Note thread fastened to one end of handkerchief and other held in the hand. This passes through bell handle.

A sheet of carbon paper is inserted under the top leaf of a pad. A question is written and the message is signed.

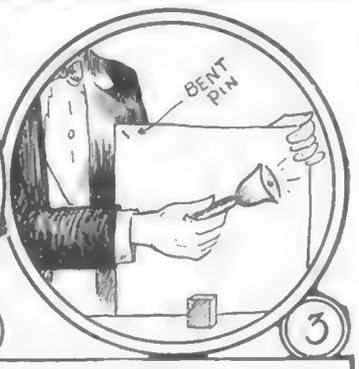
An answer is found on the second sheet over the signature in carbon. The question has not been reproduced.

The answer is previously written through carbon, the latter is doubled over as shown, preventing message being transcribed.

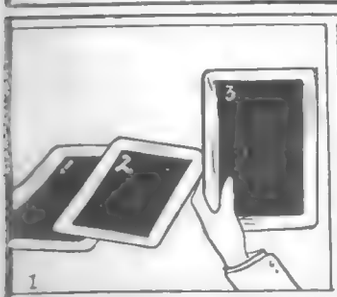


The medium holds a napkin in the manner illustrated in the drawing immediately above.

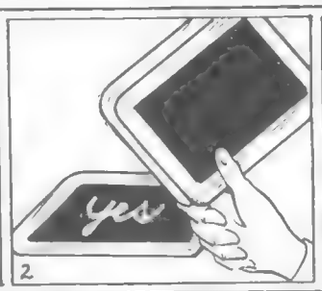
He turns body to the right, holding cloth in front of articles on table.



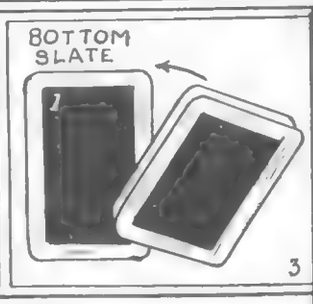
With one hand free, medium makes articles jump. Note attachment of napkin. Audience is on far side.



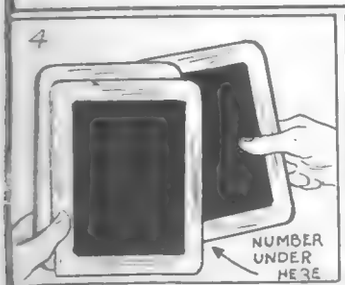
Three slates stacked together are examined and marked 1, 2 and 3 in upper corners.



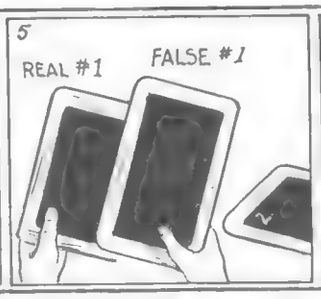
On being stacked again and taken apart a message is found on one of them.



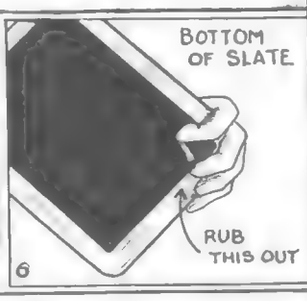
The bottom slate has a message on the under side. On top is figure 1.



When top slate marked 1 is returned to stack, it is placed underneath, number side down.



People see number 1 on top side of second slate and suppose it has been previously examined.



While marking remaining slate 3, fingers rub out 1 on the bottom. Accounting for third slate.

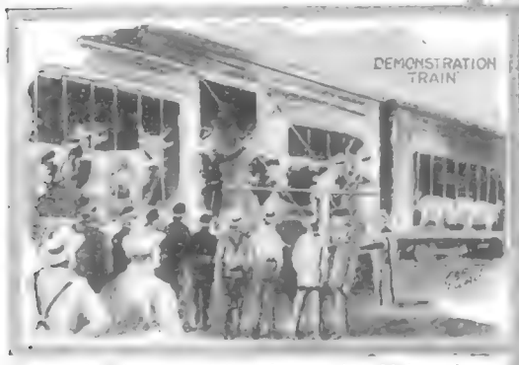
An improved version of the telephone trick is illustrated here. A person names a card in the pack and is told to call up Mr. Johnson, who tells him the name of the selected card over the telephone. No long list of names is required. Simply use the table shown, thus if the three of hearts is chosen tell the person to call Mr. Custer or Callahan. For the black cards use the title doctor or professor. For jack of clubs use Mr. X, the man of mystery and for King of Clubs or King of Diamonds use a name like Zeno.

The Month's Scientific News Illustrated

By GEORGE WALL

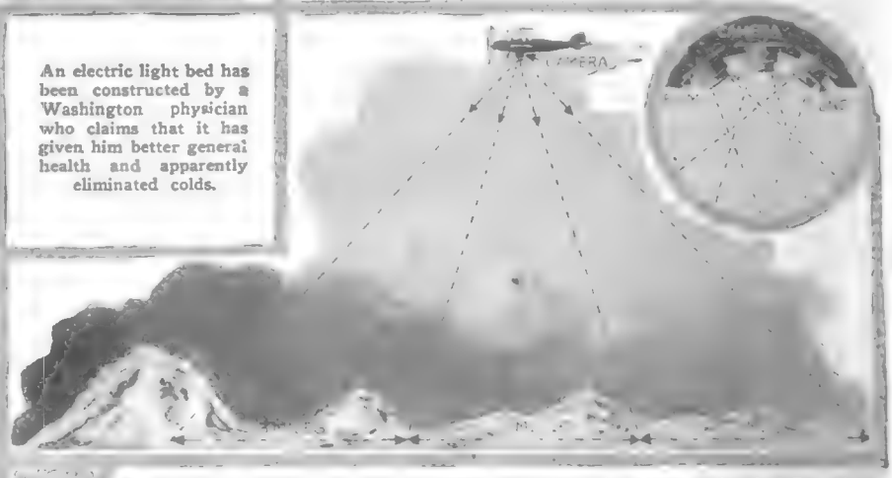
The Oregon State Department of Agriculture used flame thrower, a relic of the Great War, to destroy grasshoppers near Tule Lake. Casualties were estimated at 533,174,400.

The Army Chemical Warfare Service announces the perfection of a new gas pistol which will be used to combat crime. Unless they resort to gas masks in their raids, gunmen will be delivered gas-sick but uninjured into the hands of the law.

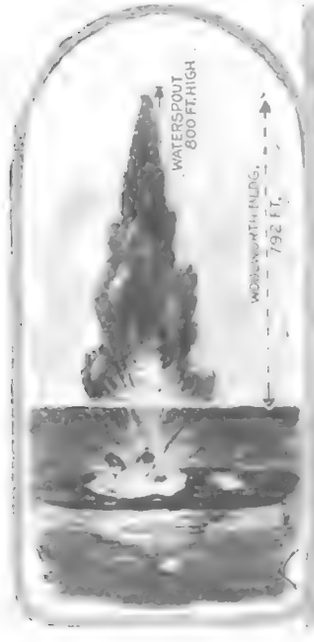


A special demonstration train carrying high-grade cattle, swine and poultry for demonstration to farmers and ranch owners, has been arranged for by the Department of Natural Resources of Nova Scotia. It will cover the territory of the Dominion Atlantic Railway.

An electric light bed has been constructed by a Washington physician who claims that it has given him better general health and apparently eliminated colds.



Three cameras of a new type have been assigned to the Alaskan Mapping Expedition for an extended aerial survey. From a height of 15,000 feet an area of 9 miles of territory may be mapped at one exposure.

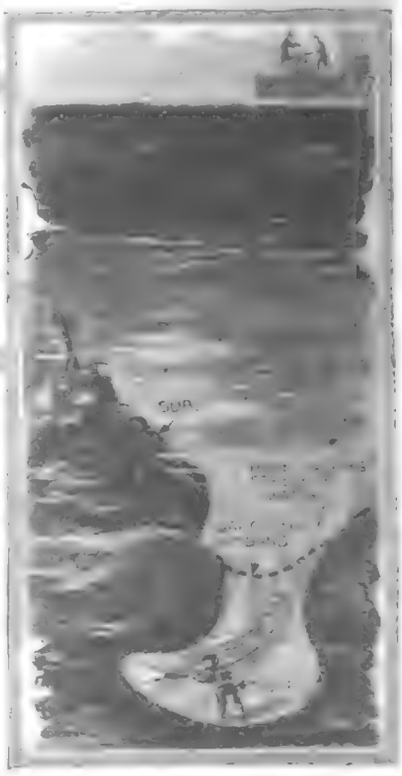


The biggest explosion of dynamite ever set off within the Golden Gate wiped out a danger to navigation, the sunken hull of the oil tanker "Alden Anderson," on May 6. The explosion caused a water spout estimated at 800 feet high and 125 feet in diameter. The Anderson burned in 1924, causing the death of 7 members of her crew.

Two students of the University of Maine have succeeded in dyeing trees from their outer surfaces to the hearts of their trunks, using the process invented by a German scientist. The indelible dye is contained in garbage cans suspended at a height, and is introduced through holes bored at the base of the trees. The sap distributes the coloring matter in from two to four days.

Above is shown the latest luxury for English infants. An automobile baby-carriage, run by a small storage battery electric motor, is geared to the wheels of the carriage platform. The nurse stands at the rear of the platform and governs the motor in the direction of travel by control levers.

During the raising of the S-51, one of the divers who was tunnelling under the wreck to pass a lifting chain around it, found himself trapped by a cave-in of the sand at the entrance of his tunnel. He succeeded in extricating himself by reversing the nozzle of the high-pressure hose used to wash away the sand.

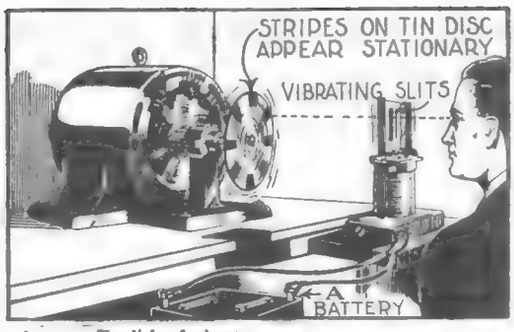


A diver salvaging the S-51 found himself trapped by a cave-in.

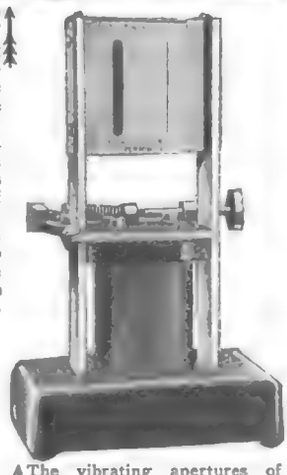
SCIENCE STEPS AHEAD

A NEW advertising device called the projectograph, developed by Samuel E. W. Haines of Oakland, Calif., projects the image of a letter on a cloud bank by the use of a highly concentrated ray from a carbon arc projector. The positive or horizontal carbon is shaped in the cross section of the desired letter, and the reflector projects the image on it in a concentrated beam of light. The arc light is adjusted to focus on a distant cloud and is very efficient in cutting through fog as shown above. A battery of these lights may be used to write a sentence or slogan across the sky, or a series of letters may be projected from one projectograph by replacing the horizontal carbon by one cut to the outline of the letter to be projected.

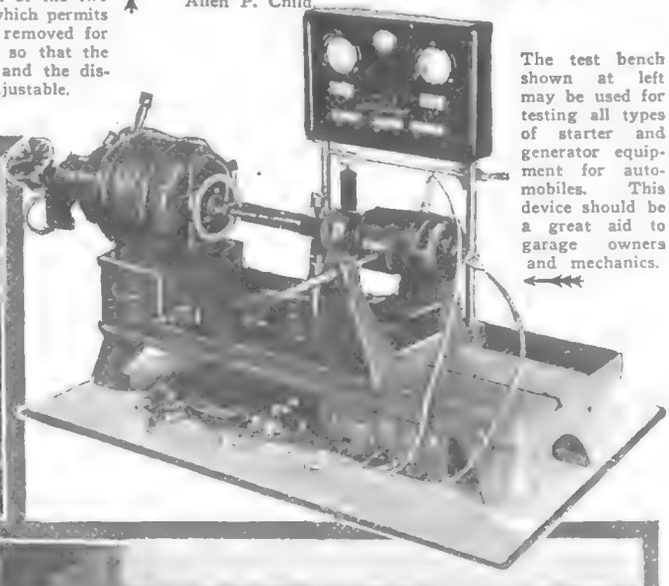
Photo above shows construction of projectograph arc light. The horizontal carbon made in the shape of the letter to be cast, may be seen at the end of the two focusing rods. A mechanism is provided which permits the horizontal carbon to be adjusted and removed for replacement. The reflector is rather flat, so that the light may be concentrated at a distance, and the distance of the arc from it is easily adjustable.



A new English device for the measurement of the speed of revolving shafts utilizes the principle of an aperture synchronized to the speed of the shaft. A disk bearing a pattern of strips as shown in the illustration above is fastened to the end of the shaft and the pattern is viewed through either of two slits in the mechanism. When the shaft speed is a little greater than synchronization, the pattern will appear to move in the direction of rotation; if less, it will seem to reverse. Aperture frequencies of 6,000 and 12,000 per minute are used, because these numbers have a large number of factors and are multiples of the standard A.C. frequencies. — Allen P. Child.



The vibrating apertures of the speed-counter may be easily seen in the above photo. The thumb screw at right is used to adjust vibrator armature.

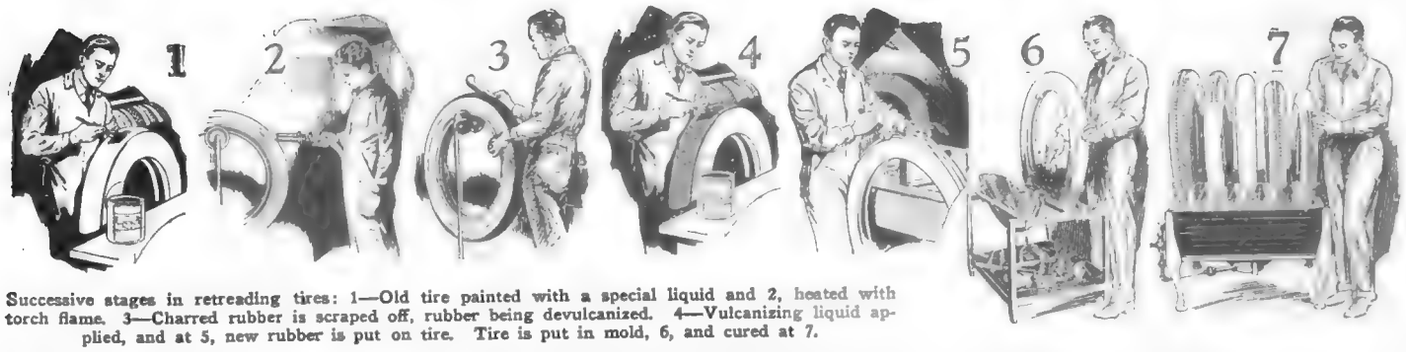


The test bench shown at left may be used for testing all types of starter and generator equipment for automobiles. This device should be a great aid to garage owners and mechanics.

HERE is the latest apparatus developed by the Bureau of Standards for counting electrons. The process utilizes high frequency apparatus similar to that familiar to radio fans. L. F. Cutiss, expert on gamma rays at the Bureau of Standards, is standing in front of the control board. Scientists have been experimenting for years with various theoretical methods of counting electrons, but until now the apparatus has been very complicated and the results all too uncertain.

Students of Pomona College, Claremont, Calif., used apparatus at right for demonstrating the action of sound waves. A musical note from a pitch pipe causes standing waves to appear in a row of closely spaced gas jet flames. By means of this process, called the Tyndall experiment, the wavelength and amplitude of sound waves may be demonstrated. Prof. Rowland R. Tileston is shown explaining the method to his pupils.

New Auto Tires from Old Ones



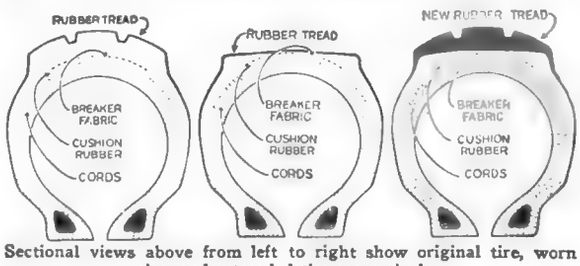
Successive stages in retreading tires: 1—Old tire painted with a special liquid and 2, heated with torch flame. 3—Charred rubber is scraped off, rubber being devulcanized. 4—Vulcanizing liquid applied, and at 5, new rubber is put on tire. Tire is put in mold, 6, and cured at 7.

IF you pay $30.00 for a new tire for your automobile and drive this tire ten thousand miles for one year, at which time the tire probably looks all in; how would you like to have this tire successfully re-treaded at a cost of ten dollars or less, so that it would yield at least seventy-five per cent. of its original mileage over again. In other words you would obtain seventy-five hundred miles at least more life out of the tire at a very reasonable cost. It is a point not generally recognized by the average motorist that when an auto tire or shoe becomes worn down to or near the first fabric or cord, that only about fifteen per cent. of the rubber has been worn from the tire. So when we take off an old shoe in this condition and throw it on the scrap pile, or sell if for fifty cents to the junk man, we are throwing away approximately eighty-five per cent. of the rubber we originally bought.

Now there comes a new and very successful method of fusing a new rubber tread on the worn tire, after the system developed and patented by Mr. Emil Nestler of New York City. His method has proven so successful in the past few years that garagemen are rapidly installing his system all over the country. The accompanying illustrations show the successive stages through which a worn shoe or tire passes in the process of being re-treaded. Of course repair shops and garages have vulcanized auto tires for many years, but these jobs have not given the satisfaction that the motorist expected of them. It took a genius like Mr. Nestler to find out just what was wrong with the old vulcanizing system. There are seven simple steps in this new process for fusing a firm rubber tread onto the old worn shoe. These successive stages are as follows:

First the old tire is thoroughly cleaned and then the rubber on the worn tread is devulcanized. A non-inflammable and non-explosive liquid is painted on the tire over the old tread face; this is heated by the blue flame of a special torch or else by that from a gasoline blow torch. The compound disappears and then a char forms on the surface. This compound under the influence of heat penetrates the old rubber rapidly and acts to de-sulphurize the rubber to a depth of about one-eighth of an inch. In the old vulcanizing process it was this sulphur content in the rubber that rendered the process impractical. When this first compound is heated it tends to hold the sulphur in suspension, but it does not remove it from the rubber; the rubber on the old tire face becomes soft and tacky.

Two photos above show same tire before (left) being treated and after (right) new tread has been fused on to old tire. At a cost of about one-third the original price, tire is renewed and good for at least 75% of its original mileage.



Sectional views above from left to right show original tire, worn tire, and retreaded tire respectively.

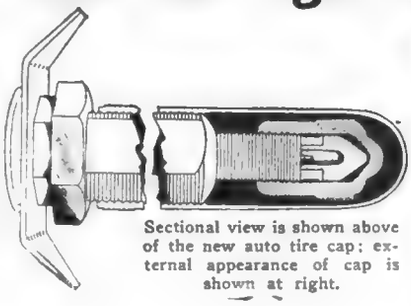
The third step is to scrape away the charred surface of the tire and the surface of the old rubber now resembles fresh uncured rubber. A second special compound invented by Mr. Nestler is now applied to the de-vulcanized rubber with a brush, and over this surface is placed a layer of thin rubber known as "Camel Back." This tread rubber comes in various widths and thicknesses so that various size tires can be taken care of. It will be noted that no rubber is removed from the original tire, as in the old vulcanizing process, which greatly weakens the tire in many cases, besides making the process more costly. All of the original rubber on your old tire is preserved by this process and the editors have examined samples of Mr. Nestler's work and also have seen the process demonstrated. The new rubber cannot be separated from the old rubber of the tire, no matter how much it is twisted. It forms one homogeneous mass of rubber, and a non-skid tread is formed on the face of the new rubber, thanks to the clever moulds used.

The sixth step consists of placing a flexible sandbag inside the shoe and at the same time placing the tire into a special split mould by means of powerful clamps. The sandbag is expanded for forcing the soft uncured rubber into the non-skid design of the mould. This clamping is done away from the curing stove.

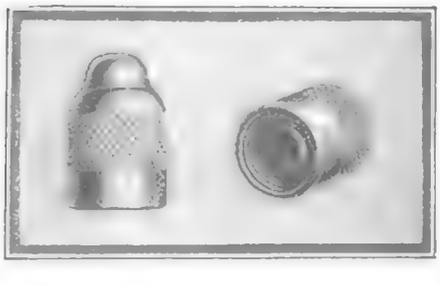
For ordinary installations the tire is covered completely with re-treading rubber and it can be cured in four sections, each one over-lapping. The moulds are so designed that the curing is uniform around the tire. No steam is used in curing and fusing the rubber together, simply dry heat from a gas burner, the heat warming the iron moulds in which the tires are clamped. Five tires can be cured at one time in the medium size stove. For the large shop there is available a full circle mould, whereby the entire shoe can be cured at one time. The time required for curing a section is forty-five minutes to one hour. Where the tire is cured in four sections this requires about five hours, including the preparation of the tire. Where the full tread heating-furnace is used, the time is reduced to about two-thirds of this. This system has been developed also for renewing inner tubes and Mr. Nestler has also perfected a very clever (rubber) compound, which is pumped into the inner tube, rendering it puncture-proof for a period of about one year.

New Air-Tight Cap for Auto Tires

THE new principles embodied in this valve cap which gives it a tremendous advantage, are ball-bearing action and compression contact. This construction renders the cap absolutely air-tight, and the inventor claims that any tire equipped with this valve cap need never be touched again until punctured or worn out. This cap is made up in three parts: An outer metal section, heavily nickel-plated; a special non-leaking packing disk, and a third or inner section which supports this disk, allowing it to contact solidly with the valve stem. Held thus firmly the packing disk cannot turn when the cap is screwed on.



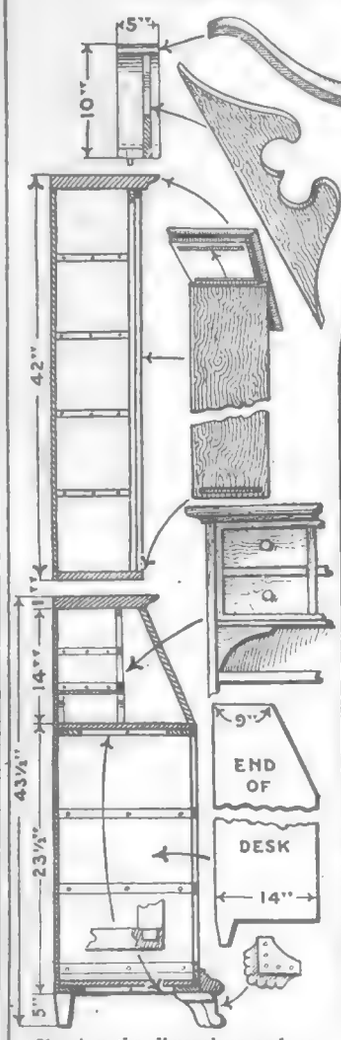
Sectional view is shown above of the new auto tire cap; external appearance of cap is shown at right.



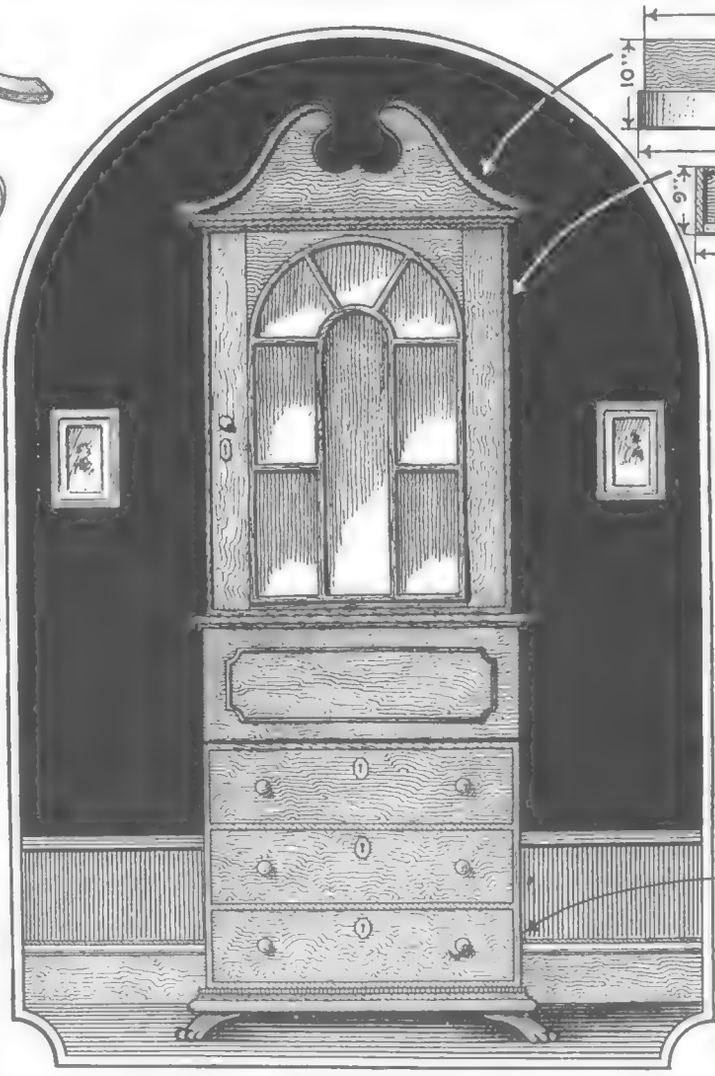
Home Mechanics

How to Make a Maplewood Desk

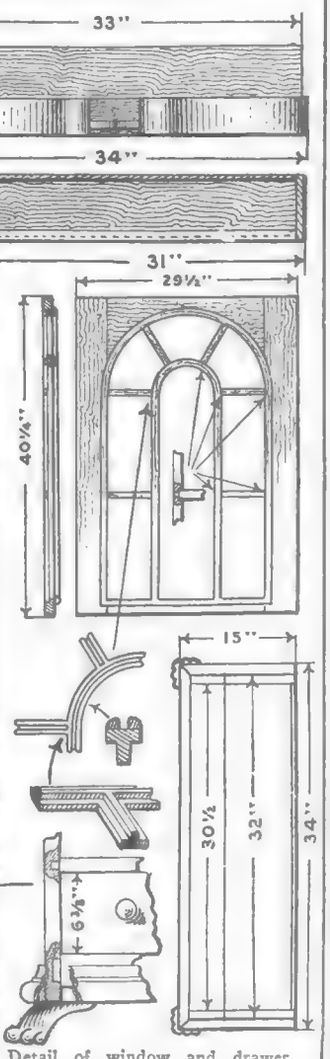
By W. M. BUTTERFIELD



Showing the dimensions and position of the upper and lower sections, and position of drawers.



Front view of the completed desk with writing shelf closed.



Detail of window and drawer, method of attaching composition leg.

A MAPLE desk in Early American Period is a beautiful piece of furniture. It can be made at home by following the illustrations on this page. Maple lumber is to be had at any first class lumber yard and the yard has the machinery to shape and cut it. Molding circular parts, mortises and tenons can all be better cut by machinery than at home or by hand.

If the home mechanic will cut accurate cardboard templates for his pieces, lumber can be shaped in the rough, ready to smooth and assemble. The mill work is done at slight cost in addition to that of the lumber.

The lower section of the desk should be assembled first. First there are two end or side pieces, each consisting of a single board 42½ inches long, 14 inches wide and ¾ inch thick. To prevent these from warping, tenons are engaged in mortises, cut one at each end of the top piece (see illustration for upper section). Each tenon is 7½ inches long, ½ inch high and ½ inch wide.

The sides are again secured by a shelf-like cross-piece forming the bottom of the desk inclosure. This piece is mortised and tenoned at each end and is 31 inches long, 13¾ inches wide and ¾ inch thick. They are further strengthened with a frame made of ¼-inch by 3-inch ply-board with mortise and tenon corner joints (as shown). This frame is glued and also screwed at each contact point.

A third support is given to the sides by a cross-piece with mortised and tenoned ends placed at the bottom of the drawer section. This piece is 31 inches long, 13¾ inches wide and ½ inch thick. It is of ½-inch ply-wood. A frame made and attached as described above is also used.

Ply-wood ¼ inch thick is used for the back. It is 37½ inches long and 30 inches wide.

The cross-pieces forming the openings for the drawers are mortised and tenoned. The bottom one is 31 inches long—including tenons, 2¼ inches wide and ¾ inch thick. The upper three are ¾ inch square and 31 inches long over tenons.

The frame holding the four drawers and two pigeon holes placed in the desk inclosure is made in one piece. It has false joining marks (see drawing) and is 30 inches long, 14 inches wide, including brackets, and ½ inch thick. A bottom, back bracket, partitions and drawer slides are other parts used here. The wood used is ply-wood.

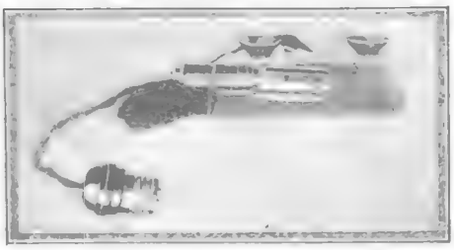
A single board 14¼ inches wide, 33 inches long and ¾ inch thick forms the drop lid for the desk. To prevent it from warping, channel grooves 2 inches deep and ⅜ inch wide are cut through the center flatwise at each end, and pieces of the maple of the above size glued in the grooves with the two grains reversed or crossing each other. Molding (¼ inch quarter round) is used to form a false panel on the front of the lid. It is used as shown in gluing the sash door molding (see illustration).

The seven drawers all have ¾-inch maple fronts, with ½-inch ply-wood backs and ends and ⅜-inch ply-wood bottoms. They are made like any machine-made drawer, so by examining a drawer

(*Continued on page 473*)

The Home Scientific

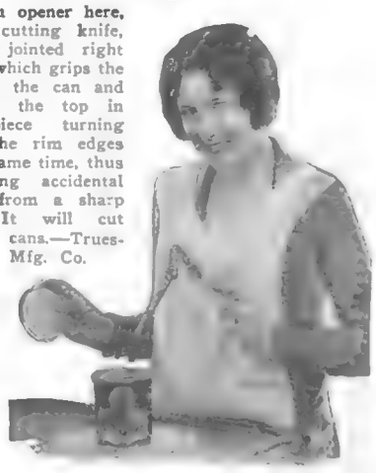
Light for Universal Purposes



These photographs show a new type of light fitted with two suction cups and a clip permitting of its attachment to any surface in any position. A ten-watt bulb is fitted in the highly nickel-plated reflector.—Dallmer Mfg. Co.

Can Opener

The can opener here, has a cutting knife, and a jointed right handle which grips the edge of the can and removes the top in one piece turning down the rim edges at the same time, thus preventing accidental injury from a sharp edge. It will cut square cans.—Truesdell Mfg. Co.



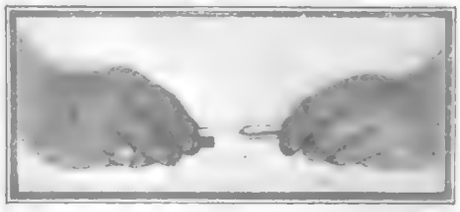
Marcel Waver

The marcel waver shown in photograph above produces a natural wave due to the curvature of the device. Even a novice can operate it.—S. M. Masse Co.

Fruit Corer

This tool is for the purpose of removing the core of grape fruit and similar fruits. The tool is pressed into the center of the fruit and then the jaws are brought together by spreading the handles of the corer. A cup-like depression results. — Boyle Products Co.

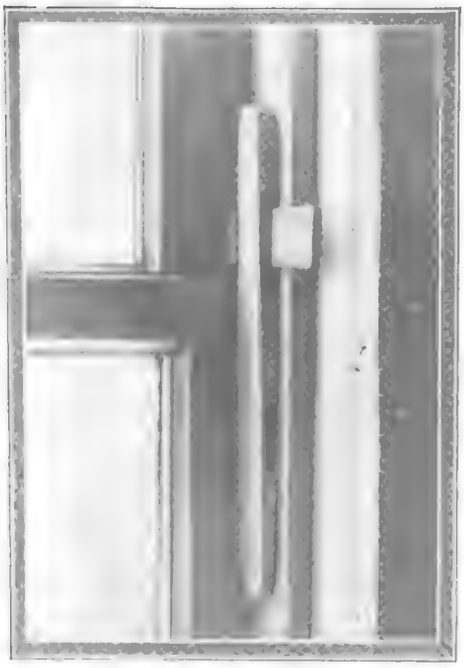
Wire Nuts



For joining two or more pieces of wire together without soldering the wires these nuts are very convenient. The ends of the wire are bared and pushed into the nut which cuts its own thread on the wire and makes a permanent connection. It is not necessary to tape the joint and four or more wires may be joined together with one nut.—Tork Company.

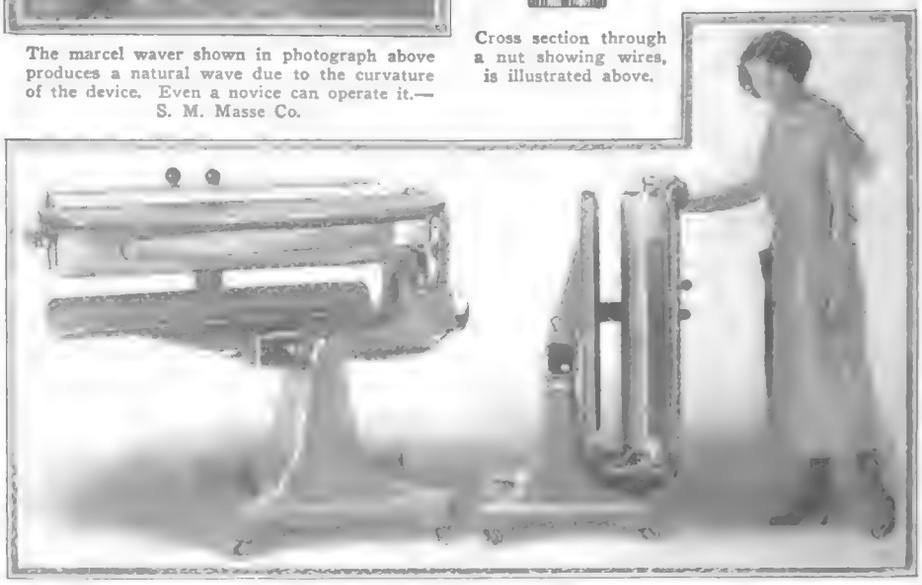
Cross section through a nut showing wires, is illustrated above.

Window Fastener



Cut two notches in a strip of wood and screw to window frame. Wedge of wood holds window open or locks it.—P. B. Bacheller.

Ironing Machine



With this device the housewife can sit and do a day's ironing in part of one morning. It is attachable to any outlet. Because the roll opens, cuffs, neckbands, collars, dresses and skirts can be ironed. —Electric Household Utilities Corp.

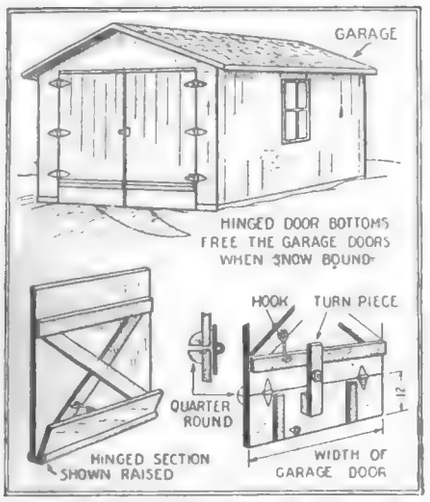
Addresses of the manufacturers of any of the above may be had upon request.

MOTOR HINTS

By GEORGE A. LUERS

A New Monthly Department Prepared by a Well-Known Automotive Engineer

GARAGE DOORS FOOL SNOW



Clever way to fit garage doors so as not to become snowbound.

SOME few years ago, not many car owners would concern themselves with the availability of the automobile in the winter. Conditions have changed, the car is an everyday necessity and the freedom with which it can be put in and removed from the garage is of especial interest.

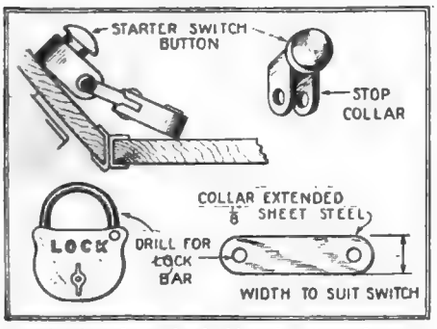
To avoid being snow bound, with the garage doors stuck fast, the car owner will save trouble and much hard labor later on, by preparing the doors of his garage, to swing freely, when the ground is covered in deep layers of snow.

The appended sketch shows one of the simplest and best ways to arrange the opening to the garage, which consists mainly of hinged bottoms to turn up and inside the doors.

The doors to be altered are cut off a distance of twelve inches at the bottoms. Pine or preferably cypress of a corresponding width is obtained, and by means of strap hinges, a piece is attached to the lower edge of each door. Battens are nailed on to re-enforce this extension, and a turn piece is arranged as shown to hold the extension down. One small hook to attach the extension when raised, completes the work of preparing the doors.

STOP COLLAR FOR THE STARTER BUTTON ON THE CAR

Repairs were being made to a building, and an automobile occupied a space where it was desired to load a truck in front of the building. The truck driver stepped into the parked and locked car, put it into gear, stepped on the starter and moved it up the block.



A simple scheme for locking the starter button.

To prevent the starter button being pressed down by children, garage attendants, thieves or unauthorized persons, thus discharging the car's battery, a simple stop collar of the type shown in the sketch can be attached to most makes.

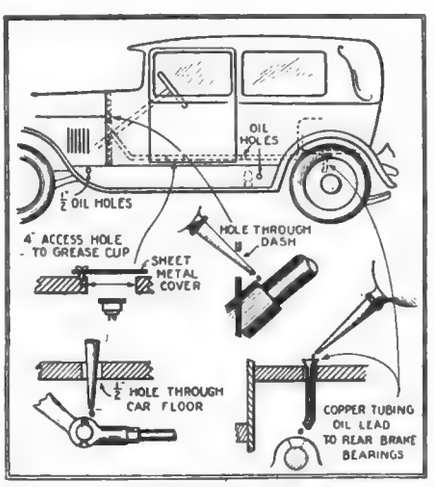
This is a U-shaped piece which clips around the stem of the starter button, bearing against the collar and seats against the body of the starter switch or floor board above.

Make the U collar from ⅛-inch sheet steel, drill two small holes in the projecting ears for the bar of a small padlock. The length of the U collar is easily determined from the starter switch, taking the measurement when the button is not pressed down.

Of course this stop collar may not appeal to the closed car owner, but the majority of car drivers, using open cars will appreciate the advantage that this stop has in avoiding discharged batteries. The protection is appreciable in contrast to the small cost in time to make it up.

HOW TO LUBRICATE HIDDEN PARTS

Under the car for oiling, is not only hard on the clothes, but also hard on the eyes. Of course you might get out the goggles and line the garage floor with rugs, but this does not necessarily remove the undesirable features of getting under to lubricate.


OIL HOLES
½ OIL HOLES
4" ACCESS HOLE TO GREASE CUP
SHEET METAL COVER
HOLE THROUGH DASH
½ HOLE THROUGH CAR FLOOR
COPPER TUBING OIL LEAD TO REAR BRAKE BEARINGS

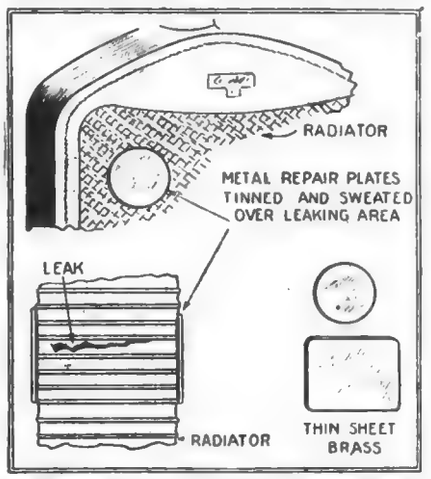
How to make accessible those out-of-sight bearings on your car.

A means which helps considerably to avoid the obstacles formed by disc wheels, low chassis, bumpers and aprons, and simplifies the oiling work is that of drilling access holes for the spout of the oil can or for oil ducts.

To illustrate this, the sketch shows the main places which require frequent lubrication and the necessary access holes for oiling from a convenient place above the car.

Small holes are drilled through the running board aprons, through the dash, through the car flooring and under the rear seat compartment directly above the part to be oiled. The size of the hole required depends on the accessibility of the part under it. If only the oil can spout is to be accommodated, a half-inch hole is sufficient, but if a grease cup is to be reached, a four-inch or five-inch hole with tin cover should be cut. Many leads can be reached with a piece of copper gasoline pipe, pushed into a small hole drilled into the floor board and the oil fed to a bearing by dropping it into the tube.

SHEET METAL DISCS MAKE SERVICEABLE AND NEAT RADIATOR REPAIRS



An effective way to repair a radiator leak. Monogram may be soldered over the patch.

On the honeycomb type of radiator leaks from a freeze or break caused by other reasons, can be neatly and serviceably repaired by means of a small metal disc on the outside and one inside.

To make this repair, cut out the two sections of metal, sheet brass for permanence, into a circular shape, or rectangular if this better meets the need. Tin one face of each piece of metal. Clean off the edges of the leaking area of the radiator and with a hot tinned soldering iron, apply a circular area of solder. Then with a hot soldering iron, press the tinned face of the repair patch to the radiator and sweat it into place.

This repair is made without removal of the radiator and does not endanger the solder in the tubes as will a blow torch which is brought against the radiator, when attempting to fill interstices with solder.

If you desire you can attach your motor club emblem right over the brass patch, polish it bright or touch it up with black enamel.

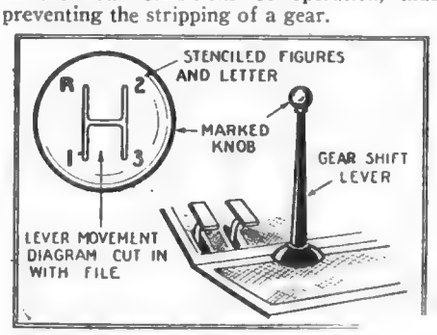
MARKED GEAR SHIFT KNOB TO AVOID WRONG SHIFT

To add this to the car, only a file and machinist's stencils are required.

Cut an H into the convex surface of the knob with a file and stamp the letter and figures at the extremities of the H.

After cutting in the index, it is made clear and distinct by filling the cuts with white paint or white wax.

The correctly cut index indicates to the garage attendant or temporary driver, the proper location of the shift lever for each of the four conditions of operation, thus preventing the stripping of a gear.



For green drivers this method of r gear shift knob will commen

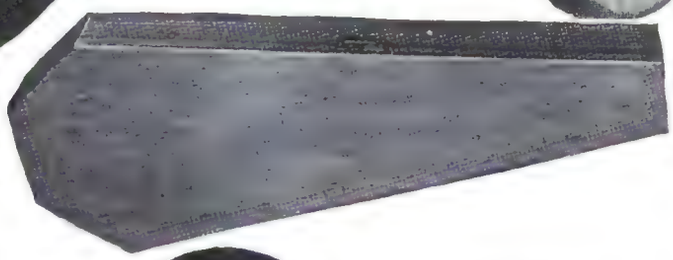
AWARDS IN $5,000.00 MATCHCRAFT CONTEST

UKELELE AND CARRYING CASE OF UNUSUAL BEAUTY WINS FIRST PRIZE—$100.00, IN THIS MONTH'S CONTEST. MODEL BUILT BY STANLEY PERRON OF SALEM, MASS.

Undoubtedly the finest model which has been entered in the Matchcraft Contest up to the present time and which won for its builder, Stanley Perron, of Salem, Mass., the coveted First Prize, appears in the photographs on this page. It was really remarkable to see what Mr. Perron had created with the matches. The ukelele and its accompanying carrying case received this month's $100.00 prize.

From the photograph of Miss Olsen, above, playing the ukelele, a fair idea of the size of the instrument may be obtained.

The above photograph shows the carying case of the ukelele open and also clearly indicates the presence of a receptacle for spare strings. The carrying case is made of matches laid on in three layers, the corners of the case being very carefully joined and glued. The builder took great pains in polishing up this very excellent Matchcraft model, so much so that the matches took on a glass-like finish and exhibited a lustre which it would take a poet to describe. The ukelele itself has a very mellow tone and surprising volume for its match-construction. Thousands of matches were required.



The photo at the right shows the carrying case closed and the back of the ukelele. Every part of the instrument, with the exception of the keys and strings, is made of matches. Notice the back of the instrument and observe the concentric layers of matches located in different planes giving rise to the artistic effect. The back was built up several layers thick and then carved down and polished.

$5,000.00 Prize "Matchcraft" Contest

WATCH FOR PRIZES IN OCTOBER ISSUE

16 Monthly Prizes

First Prize	$100.00
Second Prize	75.00
Third Prize	50.00
Fourth Prize	35.00
Fifth Prize	25.00
Sixth Prize	20.00
Seventh Prize	15.00
Eighth Prize	12.50
9th to 16th Prizes of $10.00 each	$80.00

FOR the present year, SCIENCE AND INVENTION magazine will award a total of $5,000 in prizes, in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please observe the following simple rules:

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

IMPORTANT

QUITE a few matchcraft models from contestants arrive broken every month, due to faulty packing, or weak construction. It should be remembered that boxes are often violently thrown around in transit before they reach us. Make sure first that your model is constructed strongly enough to withstand severe shocks. Then, before you send us the model, after you have it packed as well as you know how, throw it up almost to the ceiling and let it come down on the floor. Open up the box and see if the model is not damaged. Only after such a test can you know that the model will arrive safely.

All First Prize Awards will henceforth become the property of the Experimenter Publishing Company and will be used for exhibition purposes.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest, lasting for twelve months, each monthly contest closing on the first of the month following date of issue. Thus the contest for the month of September will close October 1, 1926, and prize winning announcements will be made in the December, 1926, issue. The October issue will contain July prize winning entries.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

This contest started Dec. 1, 1925, and will terminate Dec. 1, 1926.

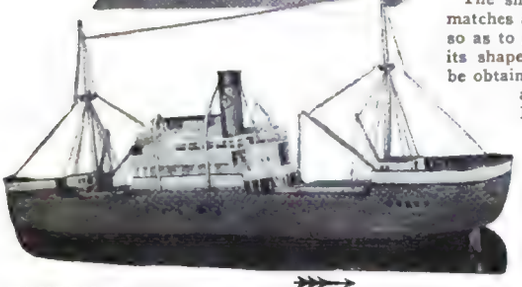
REMEMBER— This is a monthly contest offering sixteen prizes every month. Don't hesitate, send in your model now!

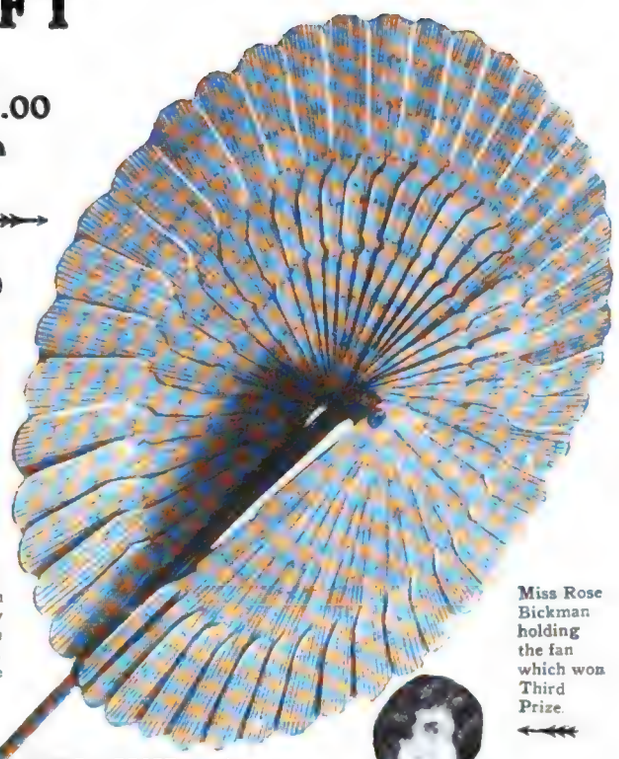
MATCHCRAFT

Model of Liner Wins Second Prize $75.00 Made by James Quinn of New York City

Eugene Jefferies' Fan Wins Third Prize $50.00

SECOND PRIZE—$75.00 was won by James Quinn of New York City for the model ship shown in the photograph above and to the left. The ship has a hollow hull and the matches around the stern were bent so as to give this part of the vessel its shape. A comparative size may be obtained by examining the photo above. Miss Sadie Bernstein is holding the vessel.



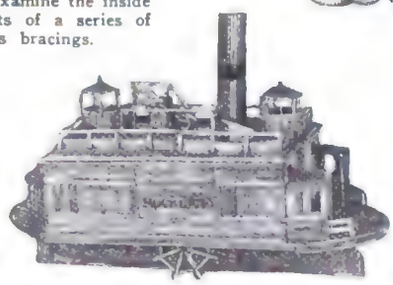


Miss Rose Bickman holding the fan which won Third Prize.

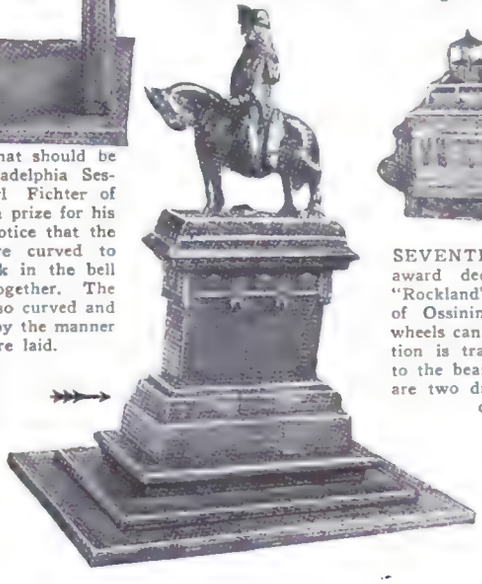
THIRD PRIZE — $50.00 was awarded the fan, constructed by Eugene Jeffries, Anacortes, Washington. The fan is less than 1/16th of an inch in thickness at its edge, the matches being built up in blocks and then cut.

FOURTH PRIZE—$35.00. The remarkable model of a locomotive and tender illustrated at the right was built by Louis A. Smith of El Paso, Texas. The model may be pushed along the rails and every portion thereof works. Even the bell cord is of match construction.

FIFTH PRIZE — $25.00 was awarded Oliver E. Kaupang of Minneapolis, Minnesota for the model of a dirigible illustrated here. The model is two feet, ten inches long and ten inches in height overall from the top of the bag to the bottom of the caboose. At the nose of the bag a door is located which may be opened to examine the inside construction. This consists of a series of spider-web-like cross bracings.



SIXTH PRIZE—$20.00. What should be more natural during the Philadelphia Sesquicentennial than that Karl Fichter of Philadelphia, Pa., should win a prize for his model of the Liberty Bell? Notice that the matches forming the bell are curved to shape. Also observe the crack in the bell and the bolts holding it together. The matches in the standard are also curved and the base artistically decorated by the manner in which the matches are laid.



EIGHTH PRIZE — $12.50. This statue of George Washington at Valley Forge is almost fourteen inches high. Pedestal, Horse and Rider are of solid construction, the latter too being carved to shape. The model is 100% matches and was built by Irving Klein of Brooklyn, N. Y.

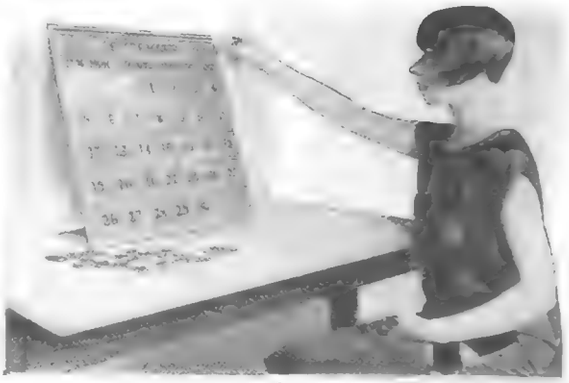
SEVENTH PRIZE—$15.00 was the award decided on for the ferryboat "Rockland" built by Warren C. Brown of Ossining, New York. The paddle wheels can be made to rotate, which motion is transmitted by means of levers to the beam on top of the ferry. There are two drive ways, one on either side of the engine-room.

FOURTEENTH PRIZE—$10.00 was awarded to Miss Beatrice M. Chasse of Central Falls, Rhode Island, for her construction of a Toonerville Trolley illustrated in the photograph at the right.

Further Matchcraft Awards

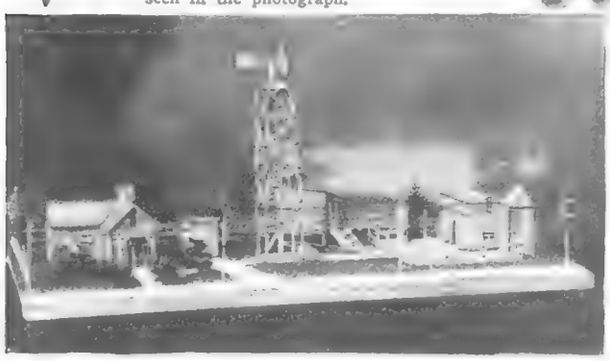
Continuing the List of Prize Winners for This Month. Your Model May Also Win a Prize, so Send it in Now

NINTH PRIZE—$10.00 was the award decided upon by the judges for the perpetual calendar illustrated in the two photographs at the right. The setting of the days of the week is permanent, but the dates may be shifted at will and the month and year may also be changed. Sufficient additional wooden slides fitting into grooves accompany the calendar and extra letters to form all of the months of the year are also included. The back is of three-ply match construction. The model was built by Chas. E. Parker of Claymont, Delaware.



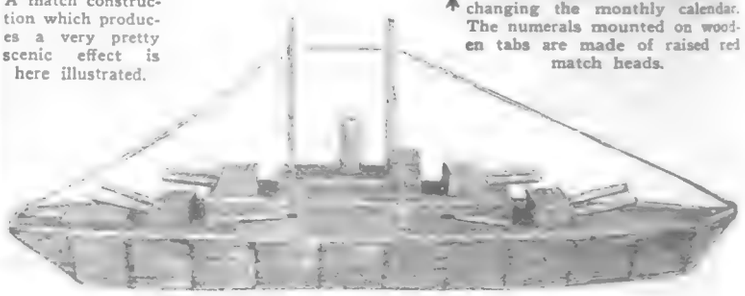
In the above photograph, Miss Shirley Hecht is engaged in changing the monthly calendar. The numerals mounted on wooden tabs are made of raised red match heads.

ELEVENTH PRIZE—$10.00. The model of farm buildings built by John E. Hackett of Hornell, N. Y., is illustrated in the photograph below. The farmer's home, graincrib, windmill, stable and silo may be seen in the photograph.

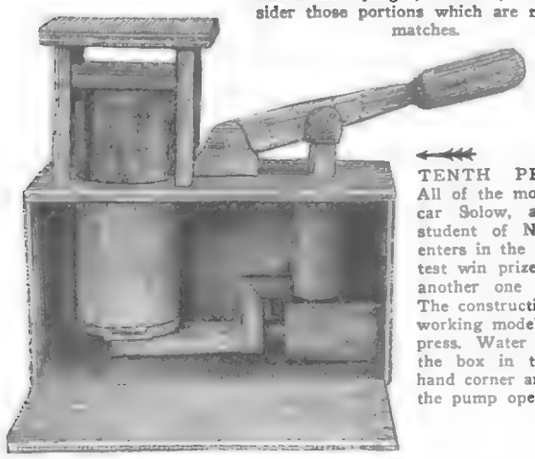


The model above is mounted on a baseboard. The judges, however, only consider those portions which are made of matches.

A match construction which produces a very pretty scenic effect is here illustrated.

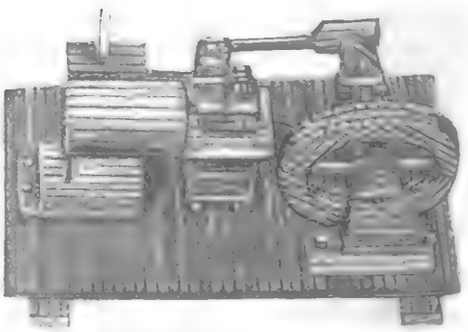


FIFTEENTH PRIZE—$10.00. Henry Ludwig of Ridgewood, N. Y., who built the Matchcraft battleship shown above is only fourteen years old and although he submitted quite a few models in previous contests this is the first one which won an award. The gun turrets are mounted on swivels and the guns may be raised or lowered and the turrets may be rotated. The construction of the hull is hollow and the matches were laid on ribs made of the same material.



TENTH PRIZE—$10.00. All of the models which Oscar Solow, a High School student of New York City enters in the Matchcraft contest win prizes and this is another one of his models. The construction represents a working model of a hydraulic press. Water is admitted to the box in the lower right hand corner and by means of the pump operates the press.

THIRTEENTH PRIZE—$10.00. To the right we see a working model of a horizontal steam engine which was very cleverly constructed by Theodore Sterrett of Port Arthur, Ontario, Canada. This model is less than four inches long and two inches in width and approximately 2 inches high.

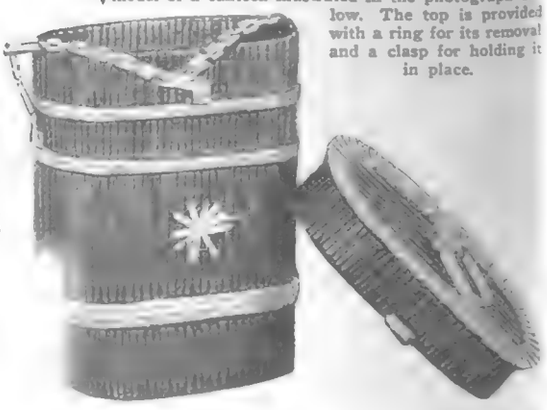


The pump and plunger and the pipes are made of matches. The piston of the pump is a solid block of matches. The table of the press is of four-ply match construction. The front has been removed to show interior of the device. More than 5,000 matches entered the construction of this model which is ten inches high and fourteen inches wide.

SIXTEENTH PRIZE—$10.00. The last of the group of prizes for this month, was awarded to Dr. A. A. Hansen of Virginia, Minnesota for his model of a canteen illustrated in the photograph below. The top is provided with a ring for its removal and a clasp for holding it in place.

TWELFTH PRIZE—$10.00. Fred Spinden of Abingdon, Illinois, whose name is familiar to all Matchcrafters because of his many previous prize winning ideas adds another to his long list by the construction illustrated here. Notice that the wheel is banded with matches which have been steamed and bent to shape. A nut on the plough shear is also made of lucifers. The shear may be turned through 180 degrees to produce a narrow or a wide furrow. Observe how the handles have been bent.

A single layer of matches forms the canteen here illustrated which is also banded with the same material. A chain of match construction serves as the handle. This chain is very uni

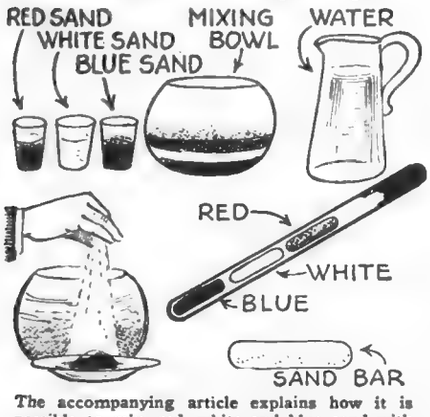


MAGIC By "DUNNINGER"

THE MAN WHO MYSTIFIED
Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

NO. 42 OF A SERIES

Hindu's Sand Mystery



The accompanying article explains how it is possible to mix, red, white and blue sand with water and then remove a handful of the particular color asked for. The bowl is not faked.

THREE sands of different colors are mixed into a container of water, the contents completely stirred with a rod. Any color is now called for and the magician placing his hand into the container, removes a handful of the sand, corresponding to the requested color, perfectly repeated, until a handful of each respective color has been removed from the water. Cakes of sand, previously made by mixing a small portion of paraffin with the sand, are concealed in the hollow mixing rod and are secretly dropped out of this rod, while stirring the contents of the container. As they are respectively removed, slight pressure will break the cake, permitting the sand to flow freely through the fingers. It is preferable to use a mixing bowl which is not transparent and yet which is not entirely opaque, as in the latter case there would always be a suspicion of a fake bowl.

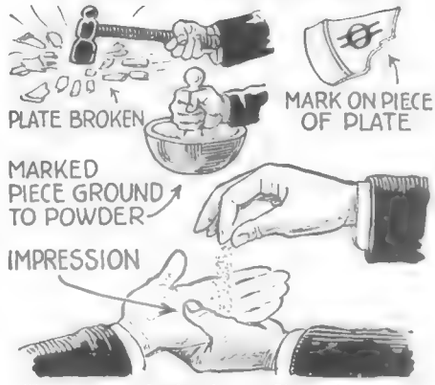
The Enchanted Cigar

A MAGICIAN offers a cigar to his friend who states his preference for a cigarette. Instantly, the cigar transforms itself into the desired smoke. This surprising trick is easily accomplished when one realizes that the cigar is drawn into the magician's sleeve by the usual pull arrangement. Most of the modern pulls operate from the waist. Consequently the one alert to this type of pull will never suspect that the old system is being used. The cigarette makes its appearance by dropping from the interior of a prepared cigar while the same passes up the sleeve. An ordinary cigar may be hollowed out to conceal the cigarette or a wooden plug covered with tobacco leaf may be used instead.

CIGAR IS OFFERED BUT REFUSED, FRIEND VOICING PREFERENCE FOR CIGARETTE. AND PRESTO CIGARETTE APPEARS AND CIGAR VANISHES
RUBBER BAND

A friend offers you a cigar knowing full well that you only smoke cigarettes, and instantly the cigar changes into your favorite smoke.

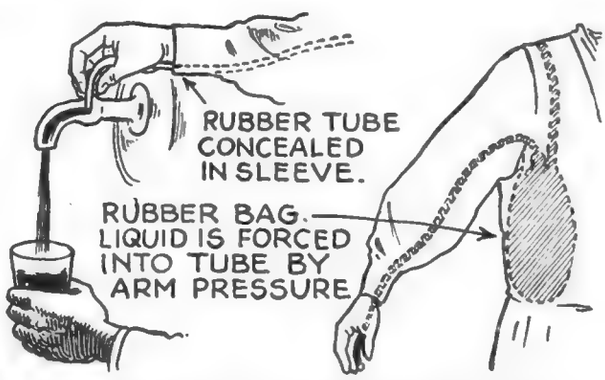
Chinese Plate Problem



Your own mark placed on a China plate which is subsequently ground into powder mysteriously appears on the palm of your hand. The method is explained herewith.

A CHINA plate which has been inspected is broken into many pieces with a hammer. A spectator selects one piece which he marks with his initial or some other insignia using a brush and India ink. The piece of plate is now ground into a powder and the powder emptied upon the spectator's hand. This is blown from the palm a moment later, whence the identical mark will be found to have been mystically imprinted in the center of his palm. The explanation is quite simple. The spectator smashes a plate with a hammer and marks one of the pieces. Thereupon the magician picks up this piece and hands it to the spectator to grind it up. While doing so an impression is carried off on the magician's thumb, which is again transferred to the spectator's palm as shown.

A Barrel of Plenty



A small barrel made entirely of glass is passed for rigid inspection. A committee is invited upon the stage and requested to suspend the barrel in mid-air assisted by four unprepared strings or chains. The Egyptian-clad wizard opens the faucet and fills glass after glass with wine, yet the transparency of the barrel shows the structure free from any liquid content. At any moment the action may be repeated after complete examination. This clever effect is merely an illusion, inasmuch as the liquid is contained in a rubber-bag arrangement concealed beneath the wizard's cloak. The liquid is forced by arm pressure through the tubing and faucet of the barrel as illustrated. It may be advisable to place the bag under the left arm while manipulating the faucet with the right hand. Controlling [illegible] is quite a natural operation.

Into the Fourth Dimension

FIRST INSTALLMENT

By RAY CUMMINGS

"A farmer's boy beside us had a handful of old horse-shoes. He began throwing them. One of them visibly went through the "ghost." Then a man with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told. The specter was unchanged."

CHAPTER I
The Ghosts of '46

THE first of the "ghosts" made its appearance in February of 1946. It was seen just after nightfall near the bank of a little stream known as Otter Creek, a few miles from Rutland, Vermont. There are willows along the creek-bank at this point. Heavy snow was on the ground. A farmer's wife saw the ghost standing beside the trunk of a tree. The evening was rather dark. Clouds obscured the stars and the moon. A shaft of yellow light from the farmhouse windows came out over the snow; but the ghost was in a patch of deep shadow. It seemed to be the figure of a man standing with folded arms, a shoulder against the tree-trunk. It was white and shimmering; it glowed; its outlines were wavy and blurred. The farmer's wife screamed and rushed back into the house.

Up to this point the incident was not unusual. It would have merited no more than the briefest and most local newspaper attention; reported perhaps to some organization interested in psychical research to be filed with countless others of its kind. But when the farmer's wife got back to the house and told her husband what she had seen, the farmer went out and saw it also; and with him, his two grown sons and his daughter. There was no doubt about it; they all saw the apparition still standing motionless exactly where the woman had said.

There was a telephone in the farmhouse. They telephoned their nearest neighbors. The telephone girl got the news. Soon it had spread to the village of Procter; and then to Rutland [illegible]. The ghost did not move. By ten [illegible] evening the road before the [illegible] was crowded with cars; a[illegible]e people were trampling the snow of his corn-field cautiously, from a safe distance regarding that white motionless figure.

It chanced that I was also an eye-witness to this, the first of the ghosts of '46. My name is Robert Manse. I was twenty-six years old that winter—correspondent in the New York office of a Latin-American Export House. With Wilton Grant and his sister Beatrice—whom I counted the closest of my few real friends—I was in Rutland that Saturday evening. Will was a chemist; some business which he had not detailed to me had called him to Vermont from his home near New York. In spite of the snowy roads he had wanted to drive up, and had invited me to go along. We were dining in the Rutland Hotel when people began talking of this ghost out toward Procter.

It was about ten-thirty when we arrived at the farm. Cars were lined along the road in both directions. Flashing headlights; chugging motors. People trampling the road, the fields, clustering about the farmhouse; talking, shouting to one another.

The field itself was jammed, but down by the willows along the creek there was a segment of snow as yet untrampled, for the crowd had dared approach so far but no further. Even at this distance we could see the vague white blot of the apparition. Will said, "Come on, let's get down nearer. You want to go, Bee?"

"Yes," she said.

We began elbowing and shoving our way through the crowd. It was snowing again now. Dark; but some of the people had flashlights which darted about; and occasionally a smoker's match would flare The crowd was good-natured; with courage bolstered by its numbers, the awe of the supernatural was gone. But they all kept at a safe distance.

Somebody said, "Why don't they shoot at it? It won't move—can't they make it move?"

"It does move—I saw it move, it turned its head. They're going up to it pretty soon—see what it is."

I asked a man, "Has it made any sound?"

"No," he said. "They claim it moaned, but it didn't. The police are there now, I think—and they're going to shoot at it. I don't see what they're afraid of. If they wanted me to I'd walk right up to it." He began elbowing his way back toward the road.

FOREWORD

In this, my own conception of the phenomena we popularly call "ghosts," I have not intended to involve either spiritualism or religion. Rather have I determined to stand upon the middle ground of science. I am aware, of course, that many of you will delare that there is very little of our coldly precise science to support what I am so boldly setting forth. Call it then—Scientifiction.

My basic conception is elusive; my characters freely admit it. Like a dream, not lending itself readily to word depiction. Purposely I have made it so, for to reduce it to an over-bald reality would paradoxically destroy the very essence of its realness. If at times my word pictures seem inadequate, I beg you to lower the printed page for a moment and let your own imagination roam.

If I can do that—stimulate your imagination, drive your thoughts from the humdrum affairs of our own little lives out into uncharted seas; and most of all, if I can thus entertain you—my purpose will have been accomplished.—Ray Cummings.

We found ourselves presently at the front rank, where the people were struggling to keep themselves from being shoved forward by those behind them. Thirty feet across the empty snow was the ghost. It seemed, as they had said, the figure of a man, blurred and quivering as though moulded of a heavy white mist at every instant about to dissipate. I stared, intent upon remembering what I was seeing. Yet it was difficult. With a quick look the imagination seemed to picture the tall lean figure of a man with folded arms, meditatively leaning against the tree-trunk. But like a faint star which vanishes when one stares at it, I could not see a single detail. The clothes the face, the very outlines of the body itself seemed to quiver and elude my sight when I concentrated my attention upon them.

Yet the figure, motionless, was there. Half a thousand people were now watching it. Bee said, "See its shoulder, Rob! It isn't touching the tree—it's inside the tree! It's leaning against something else, inside the tree!"

The dark outline of the tree-trunk was steady reality; it did seem as though that shadowy shoulder were within the tree.

A farmer's boy beside us had a handfull of horse-shoes. He began throwing them. One of them visibly went through the ghost. Then a man with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told, save that it hit the water of the creek. The spectre was unchanged.

The crowd was murmuring. A man near us said, "I'll walk up to it. Who wants to go along?"

"I'll go," said Will unexpectedly; but Bee held him back.

The volunteer demanded, "Officer, may I go?"

"I ain't stoppin' you," said the man with the star. He retreated a few steps, waving his weapon.

"Well then put that gun away. It might go off while I'm down there."

Somebody handed the man a broken chunk of plank. He started slowly off. Others cautiously followed behind him. One was waving a broom. A woman shouted shrilly, "That's right—sweep it away—we don't want it here." A laugh went up, but it was a high-pitched, nervous laugh.

The man with the plank continued to advance. He called belligerently, "Get out of there, you! We see you—get away from there!" Then abruptly he leaped forward. His waving plank swept through the ghost; as he lunged, his own body went within its glow. A panic seemed to descend upon him. He whirled, flailing his arms, kicking, striking at the empty air as one tries to fight off the attack of a vicious wasp. Panting, he stumbled backward over his plank, gathered himself and retreated.

The white apparition was unchanged. "It was just like a glow of white light," the attacker told us later. "I could see it—but you couldn't feel it. Not a thing—there wasn't anything there!"

The ghost had not moved, though some said that it turned its head a trifle. Then from the crowd came a man with a powerful light. He flooded it on the spectre. Its outlines dimmed, but we could still see it.

THIS NEW STORY
by
RAY CUMMINGS

will not only entertain you but will mystify you as well. Mr. Cummings possesses the unusual faculty of adroitly mixing science and fiction in a most attractive way. If you have read the last story by this author, "Tarrano the Conqueror"—you will look forward to an exciting tale.

A shout went up. "Turn that light off! It's moving! It's moving away!"

It was moving. Floating or walking? I could not have told. Bee said that distinctly she saw its legs moving as it walked. It seemed to turn; and slowly, hastelessly it retreated. Moving back from us. As though the willows, the creek-bank, the creek itself were not there, it moved backward. The crowd, emboldened, closed in. At the water's edge we stood. The figure apparently was now within or behind the water. It seemed stalking down some invisible slope. Occasionally it turned aside as though to avoid some obstruction. It grew smaller, dimmer by its greater distance from us until it might have been the mere reflection of a star down there in the water of the creek; then it blinked, and vanished.

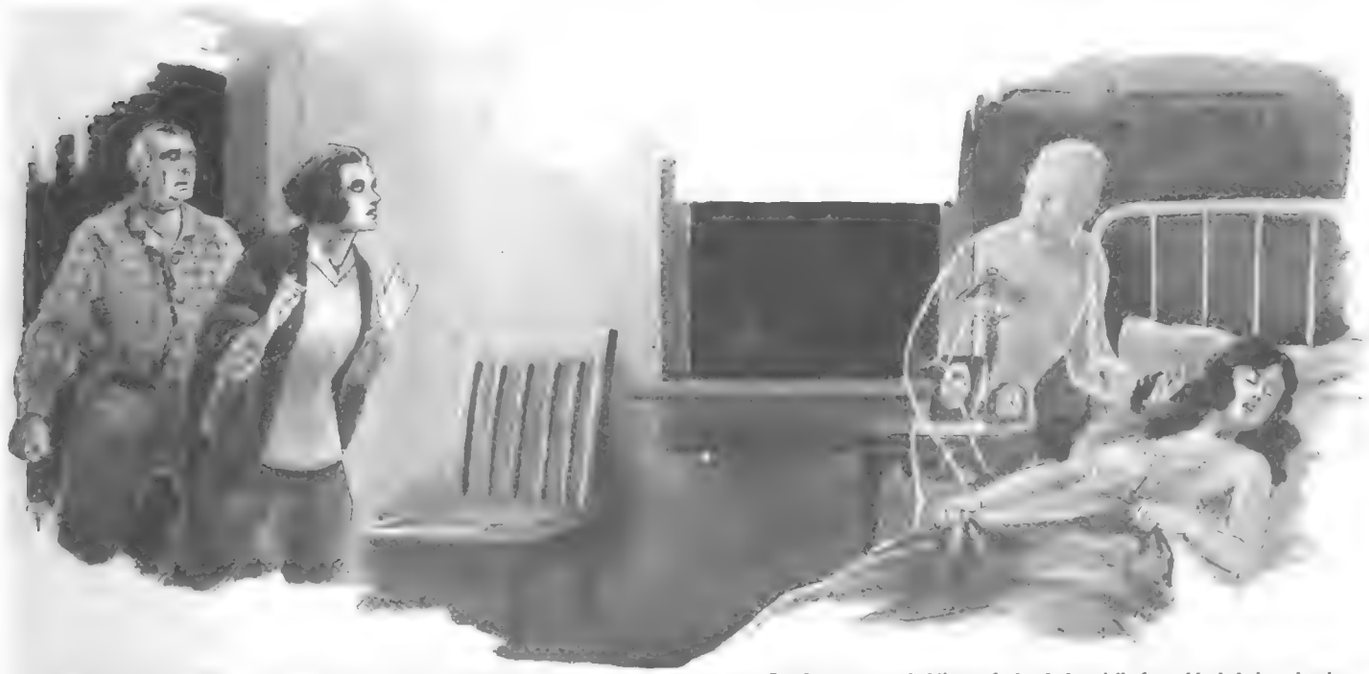
There were thousands who watched for that ghost the following night, but it did not appear. The affair naturally was the subject of widespread newspaper comment; but when after a few days no one else had seen the ghost, the newspapers began turning from the serious to the jocular angle.

Then, early in March, the second ghost was reported. In the Eastern Hemisphere this time. It was discovered in midair, near the Boro Badur, in Java. Thousands of people watched it for over an hour that evening. It was the figure of a man, seated on something invisible in the air nearly a hundred feet above the ground. It sat motionless as though contemplating the crowd of watchers beneath it. And then it was joined by other figures! Another man, and a woman. The reports naturally were confused, contradictory. But they agreed in general that the other figures came from the dimness of distance; came walking up some invisible slope until they met the seated figure. Like a soundless-motion-picture projected into the air, the crowd on the ground saw the three figures in movement; saw them—the reports said—conversing; saw them at last move slowly backward and downward within the solid outlines of the great temple, until finally in the distance they disappeared.

Another apparition was seen in Nome; another in Cape Town. From everywhere they were now reported. Some by daylight, but most at night. By May the newspapers featured nothing else. Psychical research societies sprang into unprecedented prominence and volubility. Learned men of spiritualistic tendencies wrote reams of ponderous essays which the newspapers eagerly printed.

Amid the reports now, the true from the false became increasingly difficult to distinguish. Notoriety seekers, cranks and quacks of every sort burst into print with weird tales of ghostly manifestations. Hysterical young girls, morbidly seeking publicity, told strange tales which in more sober days no newspaper would have dared to print. And in every country charlatans were doing a thriving business with the trappings of spiritualism.

(*Continued on page* 454)



"And the next night, in a Kansas farm-house, the farmer and his wife were awakened by the scream of their adolescent daughter. They rushed into her bedroom. She was in bed, and bending over her was the apparition of a [illegible] Its fingers were holding a lock of the girl's long black hair. At the farmer's shout, the ghost turned; its hand was raised—and the farmer and his wife both saw that the shadowy fingers had lifted the girl's [illegible]

Scientific Problems and Puzzles

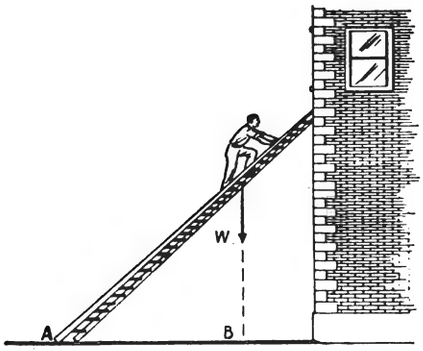
By ERNEST K. CHAPIN

HYDROMETER LEVEL

Bucket containing floating hydrometer is whirled vertically.

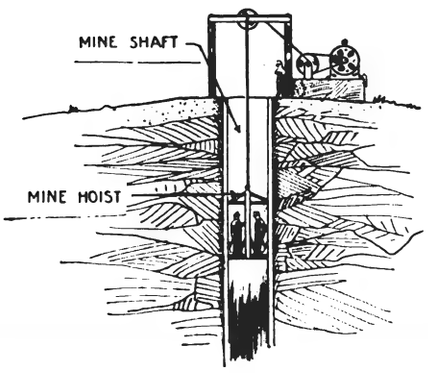
An hydrometer is floated in a pail of water. The pail is then whirled vertically at arm's length fast enough to prevent spilling water. When will it float highest, or will its level remain constant?

WHEN WILL LADDER SLIP?



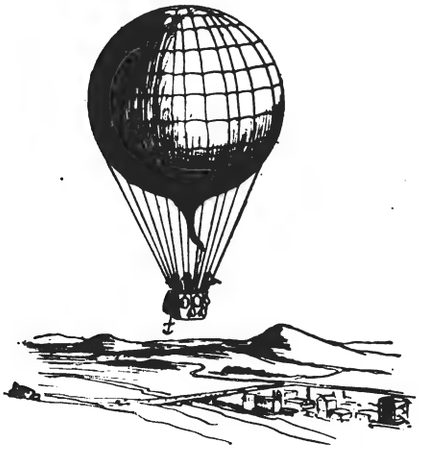
As a man climbs the ladder leaning against a wall, the ladder will have a decided tendency to slip when he reaches a certain point. Just what is the location of this point, and why is there a greater tendency to slip here?

CHANGE IN WEIGHT



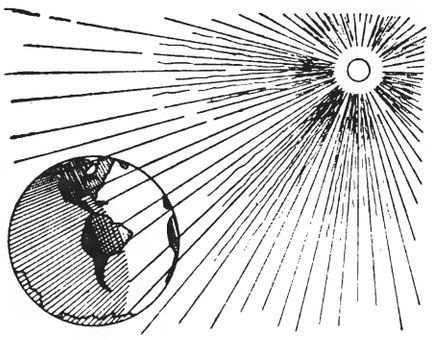
It is a well-known fact that at the poles, a person's weight is a little greater than elsewhere on the earth. It is also true that he is a little lighter at the equator than elsewhere. How do you think descent into a mine affects the weight of your body?

BALLOON ASCENSION



Does the length of the day have anything to do with the readiness or reluctance with which balloons ascend? If the speed of rotation of the earth should increase, would balloons be able to lift more or less than they can at present?

SPEED OF LIGHT



Light is propagated in space at the rate of 186,500 miles per second. It takes light about 8 minutes to reach the earth from the sun. How does this fact affect the length of the day, the time of sunrise, and the time of sunset?

Death!

Especially in cold weather, you may be tempted to start your engine with a rather rich mixture and let it "warm up" a few minutes before leaving the garage.

CARBON MONOXIDE, a deadly gas, immediately begins to discharge from the exhaust. It is heavier than air—if the doors are shut the garage begins to fill with gas.

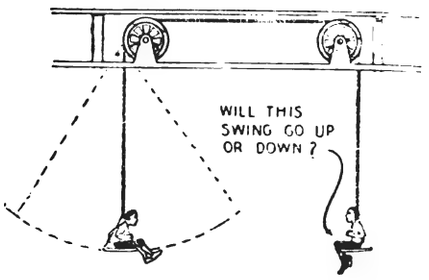
The level of the gas rises higher and higher; it creeps up until you begin to breathe it all unknowingly—for carbon monoxide is odorless and gives no warning of its insidious presence.

DEATH—quick, sudden, with no chance of escape—may come to you just as it has come to many others similarly trapped.

Keep the Garage Doors Open.

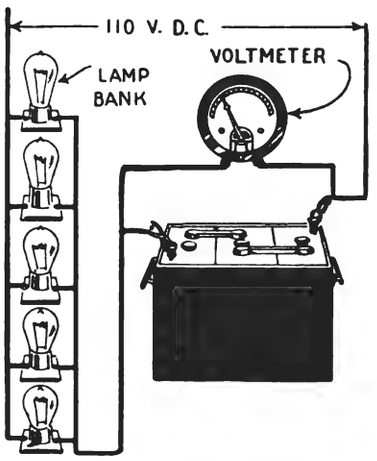
Courtesy Hartford Accident and Indemnity Company.

BALANCED SWINGS



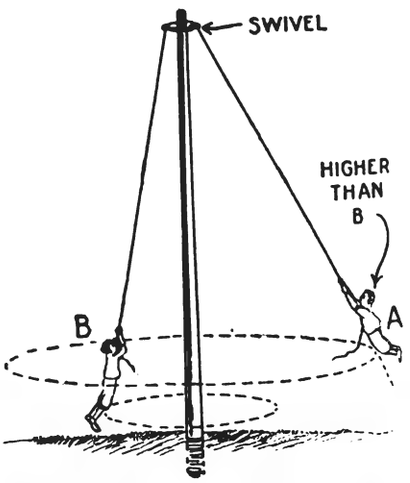
Two swings are supported at the opposite ends of a rope which passes over two freely rotating pulleys as indicated in the diagram. If two boys of equal weight are seated in the swings, what would be the effect on the positions of the swings, if one of the boys should set his swing in motion?

VOLTAGE OF BATTERY



A voltmeter is shunted across a 6-volt storage battery which is connected to a 110-volt D.C. line. A lamp bank having 20 ohms resistance is connected in series with the battery. If the voltmeter will read only up to 7 volts, can it be used in this circuit? Could it be used on a 220-volt line?

SPEED OF ROTATION



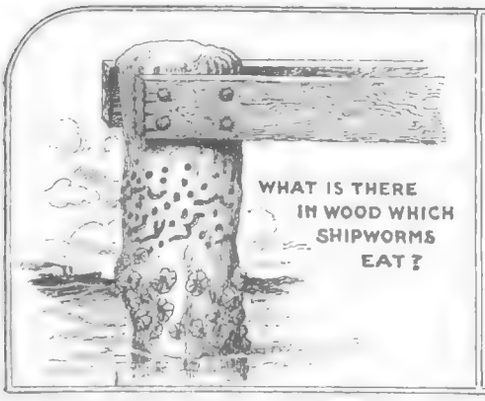
Two children swing around a pole on ropes of unequal lengths. A has a longer rope than B, but he is swinging higher. Will A make the trip around the pole in a shorter time than B?

(Answers to these problems appear on page 446)

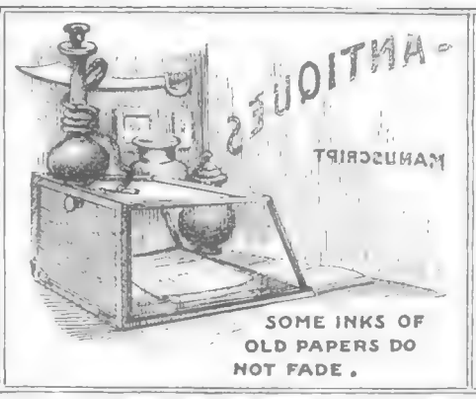
Everyday Chemistry

Some Practical Everyday Chemistry Wrinkles that We Seldom Think About

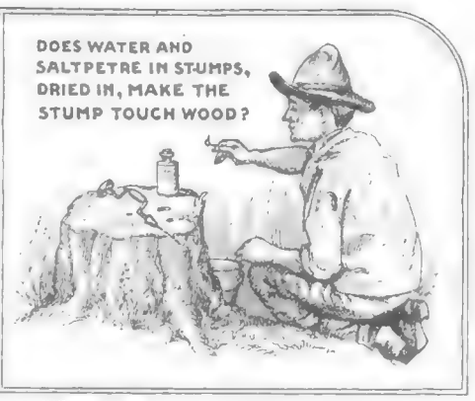
By RAYMOND B. WAILES



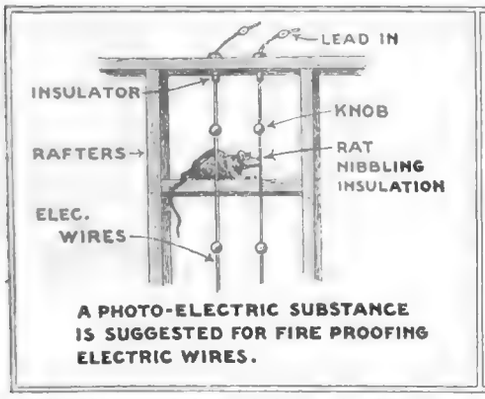
1. A chemical analysis of their stomach contents shows that they live by eating the carbohydrates present in the wood, of which sugars are a class.



2. Carbon inks have been found to outlive iron, dyes and other chemical inks. Ancient scripts usually contain carbon in a finely divided condition as the ink pigment.

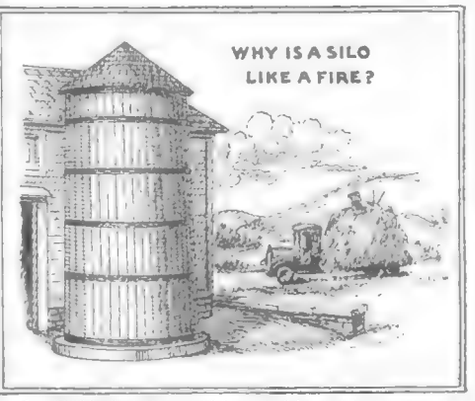


3. Stumps cannot be burned out in this manner. It would take as much saltpeter as the stump's weight to afford the fuse or touchwood properties.

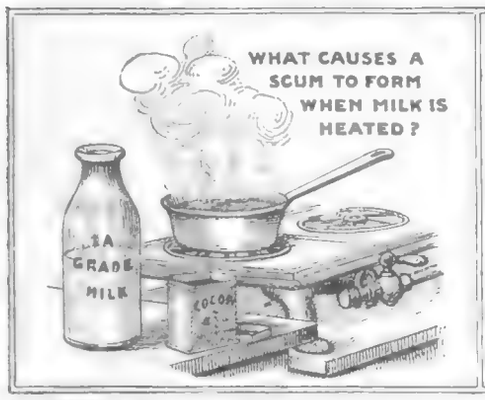


4. Selenium, used for coloring red glass and photo-electric cells, may be incorporated with wire insulation to make them fireproof.

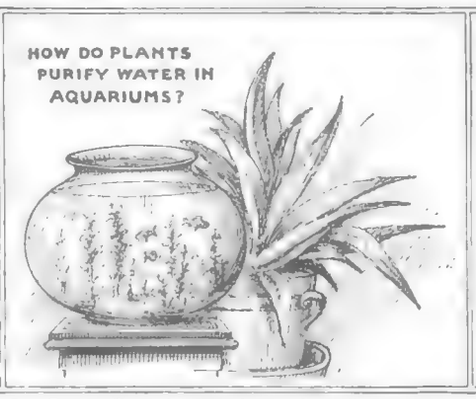
5. Soap is added to grease stock to give a body to the lubricant and as a supporting means for the grease. It is not an adulterant.



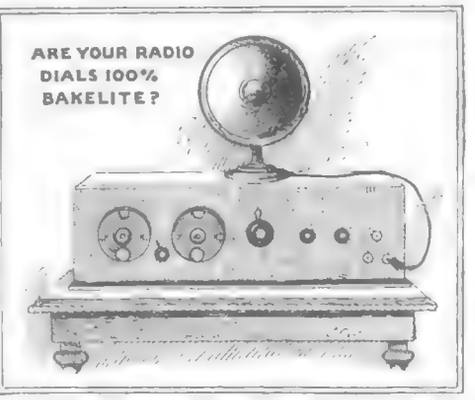
6. Oxidation, or uniting with oxygen occurs, same as wood of a fire consumes oxygen. Oxygen in a silo is used up in 5 hours, after stocking it.



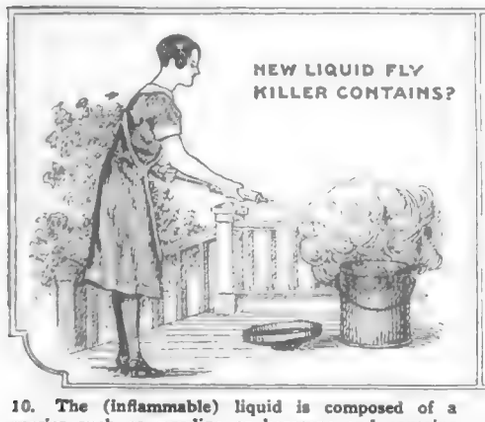
7. This is due to a compound composed largely of casein. It is not the impurities arising by boiling.



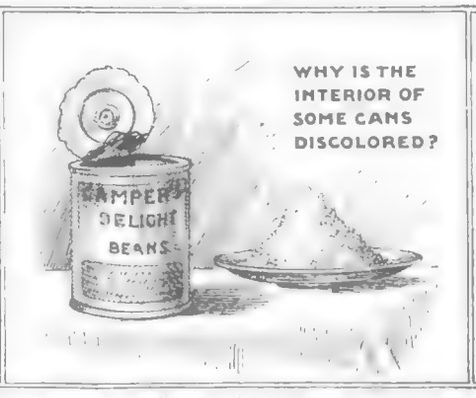
8. Green plants in aquariums give off oxygen to the water and it is this oxygen which the fishes breathe.



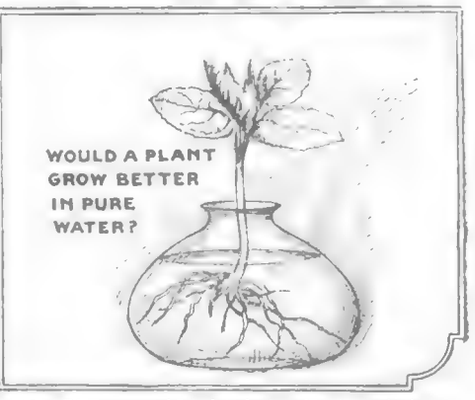
9. Finely pulverized wood, wood-flour, is used as a body in the manufacture of much of the moulded composition radio dials and knobs.



10. The (inflammable) liquid is composed of a carrier such as gasoline or kerosene and contains about 5% of dichlorbenzene, the active ingredient. An odoriferous substance is also added.



11. Imperfect tinning of the inside of the can causes some of the iron to combine with sulphur in the product, to form (black) iron sulphide, seen inside can. It is not dangerously poisonous.



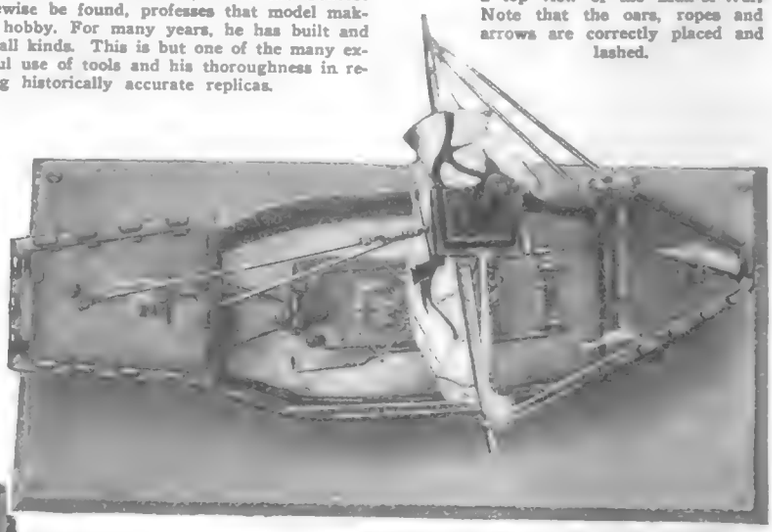
12. Plants require chemical salts in solution to make them grow. Pure water such as distilled water does not contain these plant foods or appetizers. A few plants grow in water.

MODEL DEPARTMENT

The photograph here shows the side view looking from the stern of the model Thirteenth Century Man-of-War, the construction of which was considered best by the judges and the Cup which Science and Invention Magazine presents monthly for the best model was awarded to the builder, Mr. Henry O. Havemeyer, Jr. All of the shields on the model are differently decorated with the family designs of the members of the crew. These are made clear in the accompanying print.

Mr. Havemeyer, Jr., who built the model illustrated on this page and also on page 467 of this issue, where the Contest conditions may likewise be found, professes that model making is his greatest hobby. For many years, he has built and operated models of all kinds. This is but one of the many examples of his skillful use of tools and his thoroughness in reproducing historically accurate replicas.

The photograph below gives us a top view of the Man-of-War. Note that the oars, ropes and arrows are correctly placed and lashed.



Thirteenth Century Man-of-War Wins Trophy Cup No. 5

MODEL ENTERED BY HENRY O. HAVEMEYER, JR., WINS THIS MONTH'S AWARD.

The Cup is here photographed along side of the prize-winning model in this month's Contest. Notice how the Cup towers above the model. Perhaps your model will be the next cup winner. Why not send it in? Refer to page 467 for Contest Conditions.

? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

WHO ? Will Win the Next Cup?

? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

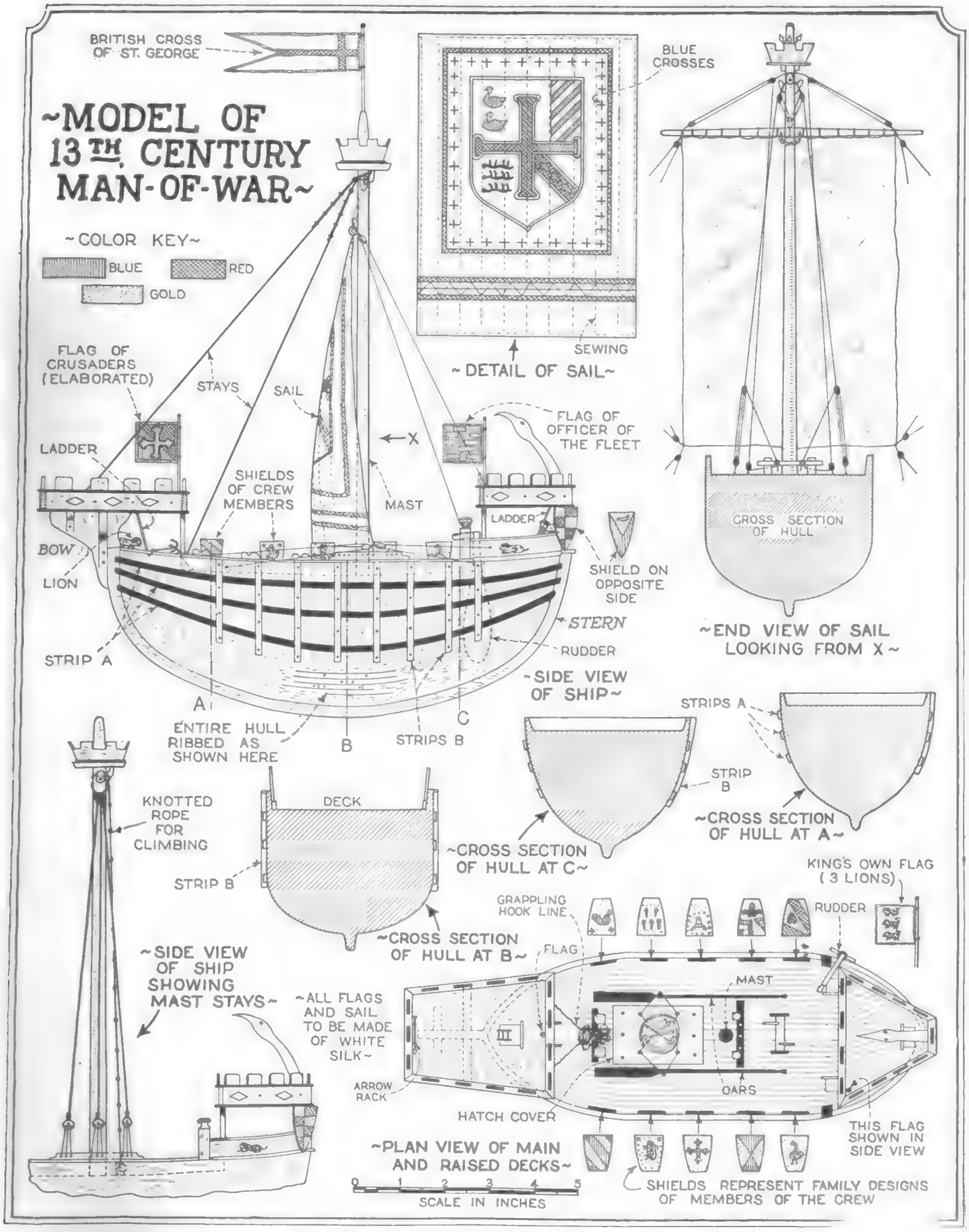
The blueprints of all Prize Wining models may be purchased from the Model Department.

A handsomely engraved cup is awarded monthly for the best model submitted during any month. The full conditions of the contest will be found in this issue on page 467. Is the cup not worth striving for?

The photograph at the left gives us a side view of this remarkable little model. Close observation will reveal the extreme care exercised in its construction.

PERHAPS YOUR MODEL WILL WIN THE NEXT CUP. HAS IT BEEN ENTERED?

Model Man-of-War Wins Cup



Above we see the complete details of the very excellent model of a Thirteenth Century "Man of War" which was built by Henry O. Havemeyer, Jr., and for which the judges have awarded him this month's Cup and Certificate. The entire hull is ribbed as the specifications indicate and accordng to the builder is an exact replica, built to scale of ships similar to those which were used in the fleet of Richard Coeur de Lion and th Notice that this vessel was steered by a rudder which is back of the ship, but hangs down on the starboard side

Model Department will supply blueprints of the ab

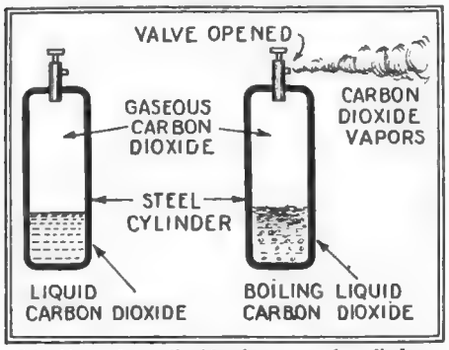
See past issues for other ship models and blueprin

One Hundred and Sixty-Six Degrees Below Zero [Fahrenheit]

Fascinating Experiments With Carbon Dioxide Snow

By O. IVAN LEE, B.Sc., F.M.S.A.

LIQUID carbon dioxide can now be obtained cheaply and easily in small steel cylinders. Following is an illustrated description of how to make "carbon dioxide snow," and with its aid to perform many very wonderful experiments made possible by the intense cold obtained.

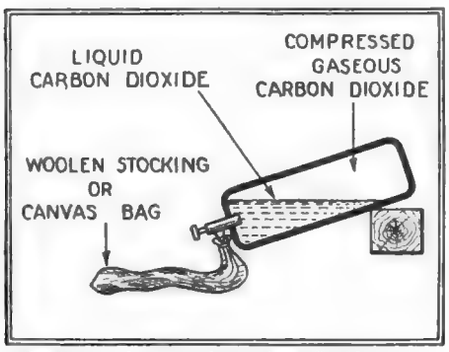


Liquid carbon dioxide in a steel cylinder. When tap is opened it starts to boil.

The cylinder as received is only *partly filled* with liquid carbon dioxide, the space above being filled with gaseous carbon dioxide under great pressure.

If the valve is opened while the cylinder is in an upright position, the compressed gas merely escapes as a colorless or white vapor, being replaced by more from the liquid carbon dioxide below which boils as the pressure is lowered. The gas coming out is cool, but not intensely cold, and is rapidly dissipated into the atmosphere.

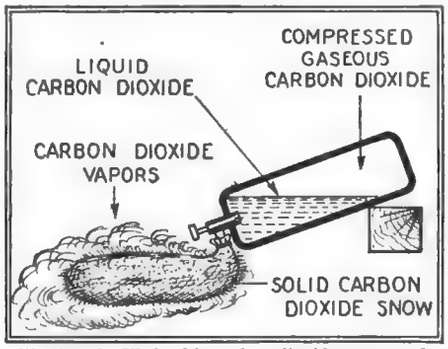
The cylinder is laid down on the floor in an inclined position with the valve end considerably below the level of the other end. This permits *liquid* carbon dioxide to be forced out of the valve by the pressure of the compressed gas above it. Over the valve outlet is firmly tied a woollen stocking or canvas money bag. The operator may conveniently sit astride the cylinder during the next operation.



Getting ready to make carbon dioxide snow. Note bag into which gas is to flow.

Everything being in readiness, the operator should firmly open the valve sufficiently wide to insure the liquid carbon dioxide ample opportunity to escape, bearing in mind, too, that *there is absolutely no danger in conducting this experiment.* The escape of the gas is accompanied, however, by a rather terrifying loud hissing noise like that of a boiler blowing off steam, together with the production of voluminous clouds of white smoke which roll across the floor in a kind of billowy fog agreeably cool to the ankles to one walking therein. The bag or stocking becomes distended, white gas escapes at every pore, and a kind of hoar frost speedily covers it. In a moment, the bag will be found completely filled with *something firm and solid.* The valve is now shut off.

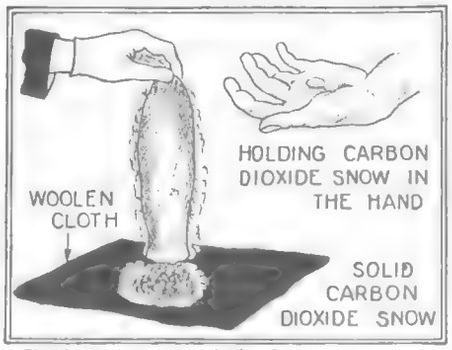
The contents of the bag are now shaken



The bag is filled with carbon dioxide snow and the gas is escaping through the pores of the cloth.

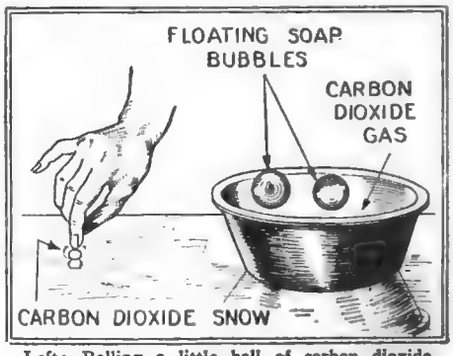
out on a woolen cloth, using a cotton gloved hand if necessary to detach any adhering lumps. The snow white solid material always surrounded by a halo of white vapor, is solid carbon dioxide having a temperature of —78.5 C. below 0 C. (109.3 below 0 F.)

The snow is so intensely *cold* that by reason of the relatively high temperature of objects at ordinary or body temperatures, they are very *hot* compared to it. As a consequence, the solid snow never really is in contact with objects on which it apparently reposes. It behaves, in fact, exactly



Shaking snow out of the bag upon a non-conducting square of woolen cloth. Holding a lump of snow in the hand.

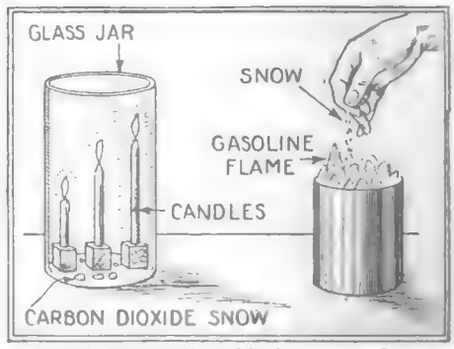
like drops of water on a red hot stove, dancing around on a cushion of vapor until completely *sublimed*, since the carbon dioxide passes directly from the solid to the gaseous state. Lumps may be safely and comfortably held on the palm of the hand or between the fingers, *so long as they are not pinched, pressed or squeezed.* In this event, one will actually be "burned" (*i.e.*, frost-bitten), for the same reason that a blister is produced if one neglects to wet the finger before touching a hot flat-iron.



Left: Rolling a little ball of carbon dioxide snow about on a plate. Right: Floating soap bubbles on the gas.

Solid carbon dioxide snow is now retailed in New York City at least, in chain candy stores, under the trade name of "Dry Pack." It is sold in paper cartons at 60c. per pint and will keep for 10 or 12 hours, and can be used directly for all the experiments described.

A piece of the solid snow placed on a polished surface and slightly touched by the finger, glides rapidly over the surface as if it were supported on invisible wheels.



Extinguishing candles with the snow and putting out a gasoline flame with it.

A few lumps of the snow are thrown into a basin and allowed to evaporate. If soap bubbles are then dropped into the basin, they will float around in it buoyed on an invisible surface of carbon dioxide gas which is heavier than air, like corks on water.

Several lighted candles are placed at different heights in a glass jar and some lumps

THE CONSTRUCTOR

Constructing An Inlaid Checker Board

By H. L. WEATHERBY
Director of Manual Arts of Public Schools of Montgomery, Ala.

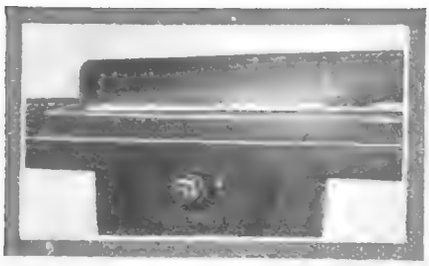


Figure 1. Saw both pieces of veneer for the squares into strips one and one-half inches wide with the grain, using a smooth-cutting saw. In case a machine saw is not available a sharp knife and a straight edge may be employed. In the real sense of the word, this is not an inlaid checker board, but really a built-up checker board which, when finished, will well repay the maker for the small amount of effort required in its construction.

Figure 2. Tack these strips to a flat board using small brads, driven in only a short way, alternating white and black woods. Glue narrow strips of paper along the joints. Any good wrapping paper will do. Line the ends up against a thin strip of wood. Allow twenty-four hours for glue to set. Walnut, mahogany or other naturally dark-colored wood forms the dark squares and holly or maple makes the light-colored squares of the checker board.

Figure 3. Saw the square thus formed into strips one and one-half inches in width across the grain. There will then result strips of wood one and one-half inches in width made of alternate black and white squares. By reversing each piece of wood, end for end, not upside down, the pattern is easily formed.

THE construction of an inlaid checker or chess board is not as difficult as might appear at a first glance. It is not really an inlaid board as we think of inlay ordinarily. The small pieces are built up rather than inserted and even the novice mechanic, who is a lover of the game, need not be afraid to tackle the job of building a checker board such as the one illustrated.

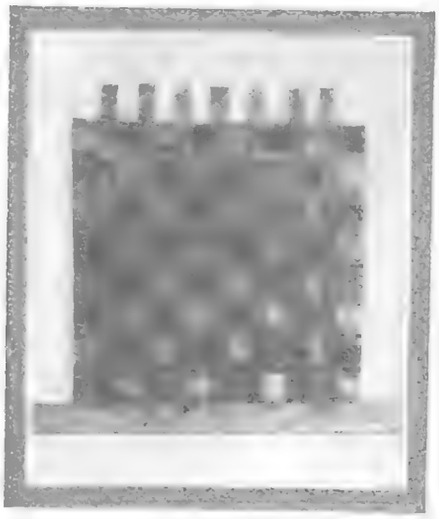


Figure 4. Tack and tape these strips as in step number 2, being careful to alternate the strips so that the squares come right—that is so that a white square comes next to a black square.

A machine saw, although not absolutely essential, is desirable for cutting the pieces since more accurate work may be done in that way. However, the veneer from which our squares are made can be cut entirely by hand with a good straight edge and a sharp knife and the remainder of the processes call for no particular tools or apparatus.

The materials called for are as follows:

1 piece of 1/16-in. sawed veneer, about 12 in. x 16 in. of black walnut, mahogany, or other naturally dark colored wood.

1 piece of the same size in a good grade of hard white wood, holly, maple, or even a good white hard poplar will do. The above mentioned pieces go to make up the squares.

Now we need a couple of yards of inlay line. This may be purchased in any design desirable from houses handling this type of material, at very small cost.

We will next need a piece of veneer about 6 in. x 16 in. which we will cut into four strips for the border. A piece of walnut or mahogany veneer for the back and a ¼ in. 3-ply panel; each to be about 16 in. square completes our material list with the exce-

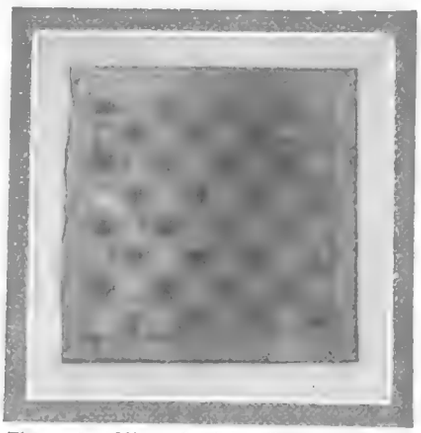
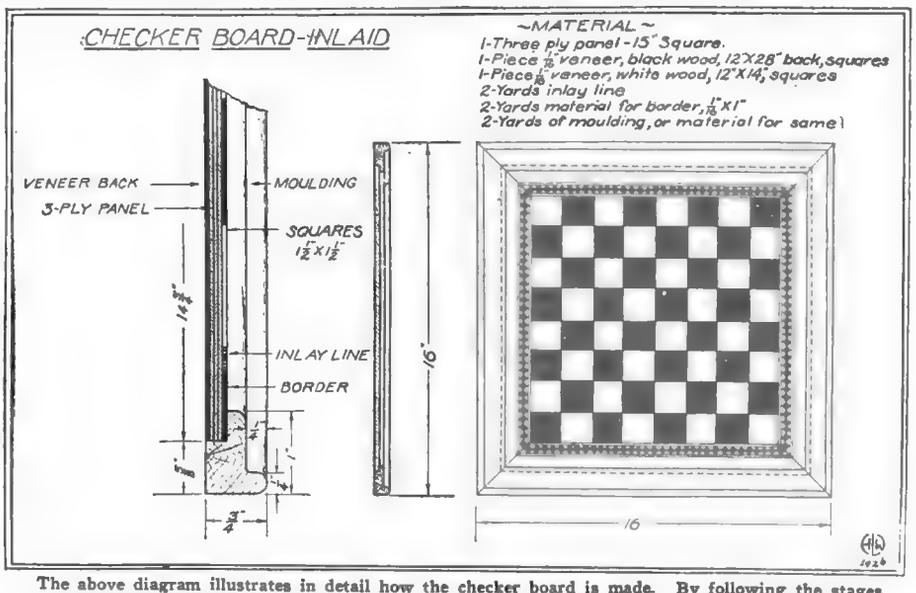


Figure 5. Mitre the inlay line and border, being careful to get good fitting corners. Tack these around the main part of the board in position and tape. This taping should all have been done on one side.



The above diagram illustrates in detail how the checker board is made. By following the stages illustrated in the photographs even the novice should have no difficulty in reproducing the same.

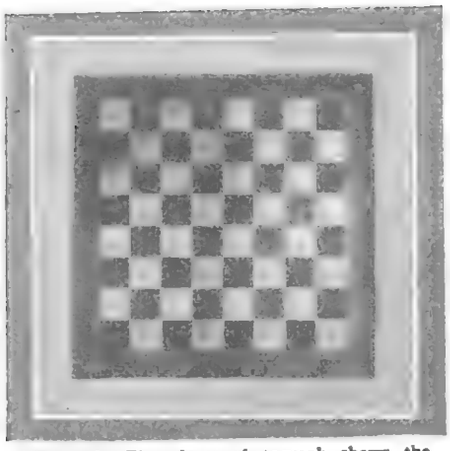


Figure 6. The above photograph shows the reverse side of Figure 5.

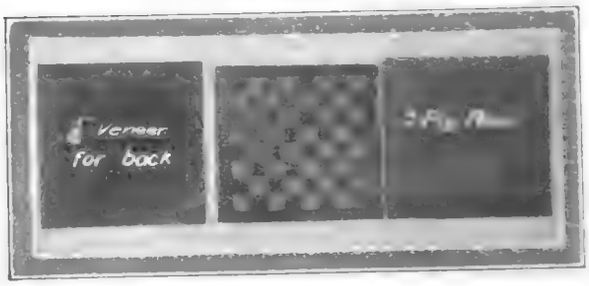
tion of four mahogany pieces ⅞ in. x 1¼ in. x 14 in. for the frame. A piece of veneer must be glued to the bottom side of the board to correspond with the squared or top side in order to overcome a tendency toward warping.

The processes of construction are very clearly illustrated by the photographs. After the final assembly the whole board is given a coat of hot linseed oil as a protection and also to enrich the natural colors of the wood, then a couple of coats of white shellac, rubbing lightly with very fine sandpaper between coats, and then finally two coats of rubbing varnish, allowing a couple of days for drying between varnish coats and then rubbing with pumice stone and oil, or pumice stone and water.

The back side should be covered with a piece of felt which should be glued on, as a protection to the furniture on which the board is placed.

If directions are carefully followed the results will be very gratifying, and a checker board fit for a family heirloom will be the result.

Fig. 8.—Now glue the parts together with the square of plain veneer on the bottom, the piece of 3-ply panel in the middle, and the squared veneer on top, exerting all possible pressure with the clamps. Be sure not to try glueing the taped side to the panel. Allow ample time for glue to thoroughly set, then scrape paper off and sandpaper.



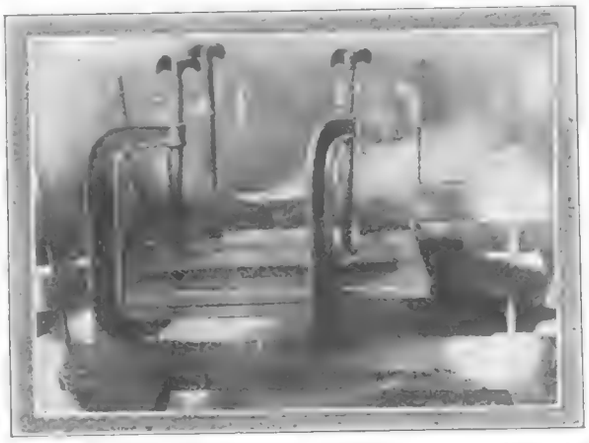


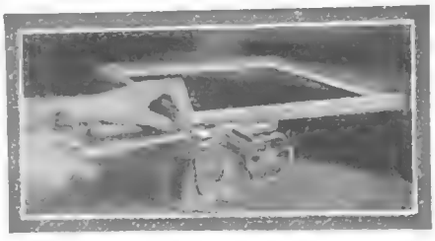
Figure 7. The parts are now clamped together for gluing.

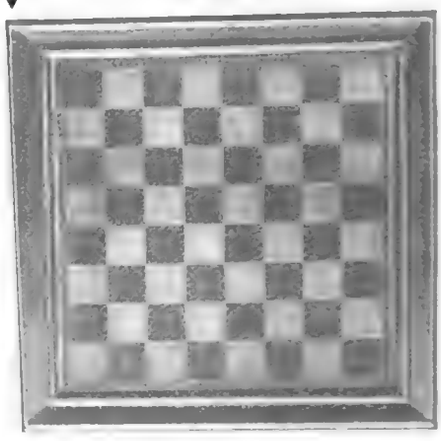
The photograph below shows the finished checker-board, the construction of which is here described.

Figure 10. The finished frame at the left.

Figure 11. The finished checker board, right.

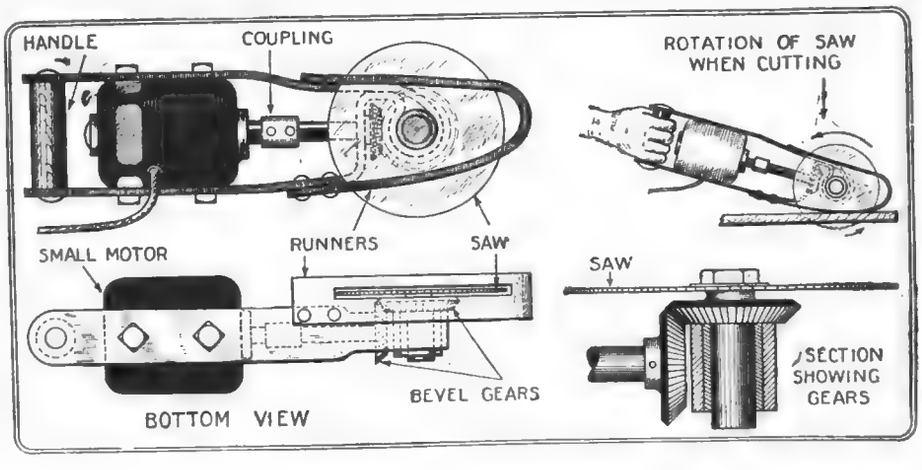
Figure 9 below. Make up the frame either with a combination plane or with the circular saw. Nail and glue the mitre corners together, then fit the board into the rabbet and the frame and glue into place.





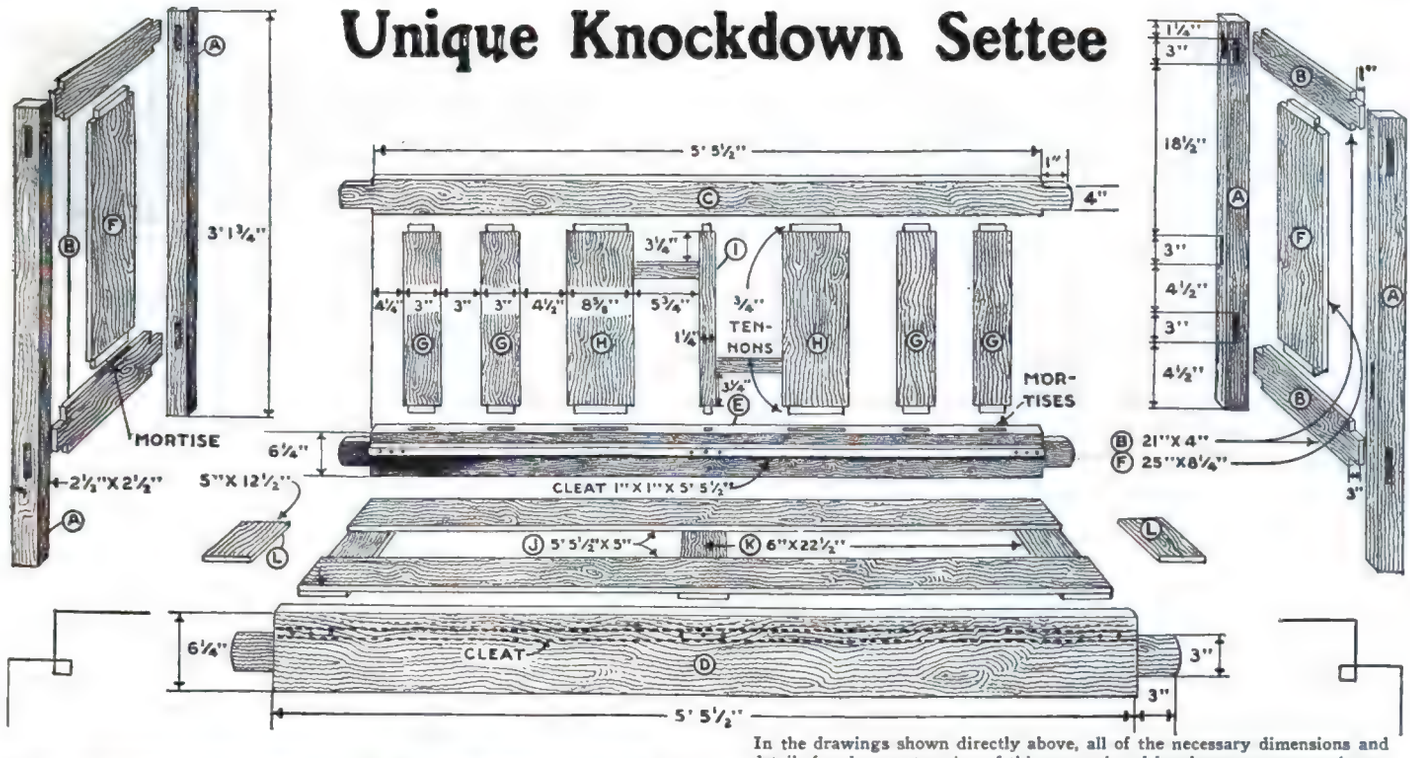
Rotary Hand Saw Made from Small Motor

WORKING somewhat along the lines of a swing saw, for operating a circular saw cutter by hand and pushing it across the wood to be cut, it is possible to make up from a small fan motor or sewing machine motor, a combined motor and saw that is portable and takes the place of the usual rip or cross cut hand tool. For this construction, having procured a light weight motor, only a small circular saw, two bevel gears, some strips of iron and some of cold rolled steel and bronze for the shafting and bearings are required. In the attached drawing, a construction is shown, without dimensions, which can be followed in making up one of these tools. Starting at the handle, a round wooden block, securely attached to the rear of the motor, is the hand grip for applying the cutting tool. Two iron or steel straps, parallel with the motor shaft, jointly secure the handle, motor and the gear and saw bearings. A short shaft coupled to the motor, carries one bevel gear on the other end. The second shaft forms the saw mandrel and carries the other bevel gear. It is necessary in making up this tool to drive the saw in the direction indicated, and for that reason the location of the bevel gears and the rotation of the motor must be considered. It is possible also in working up the runners or guides to make these adjustable for depth of cut or for varying with the size of the saw to be used. The circular saw may be removed and another easily substituted.—G. A. LUERS.



The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see to it that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

Unique Knockdown Settee



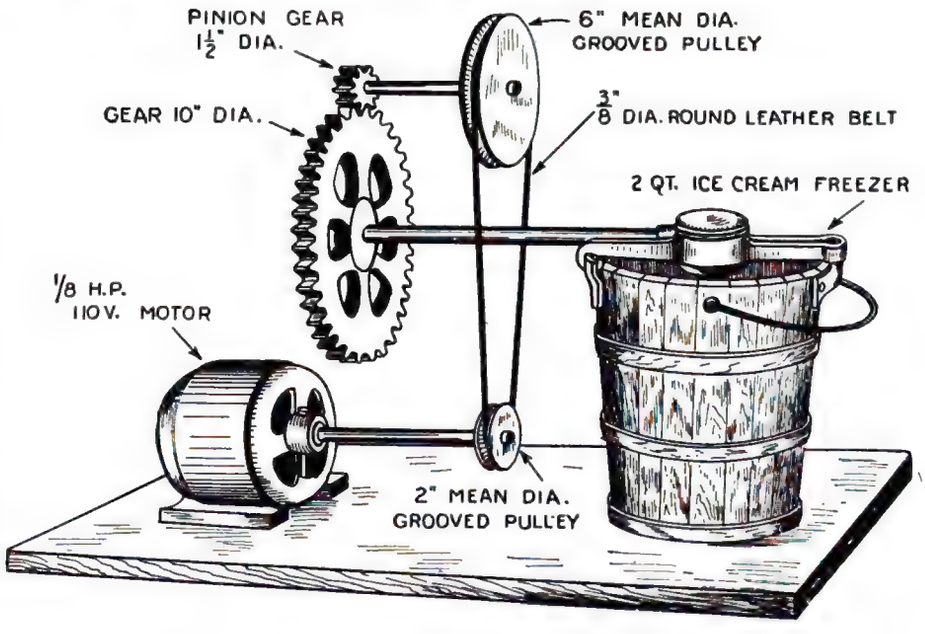
In the drawings shown directly above, all of the necessary dimensions and details for the construction of this unusual and handsome settee are shown. The carpentry work required is very simple and can be performed by anyone who is at all handy with ordinary woodworking tools. There is no undesirable complication.

A VERY simple and dignified settee that can easily be used to grace any room in the house is illustrated in the photograph at the immediate left and is shown in detail in the reproduced drawings directly above. Note how simple each and every part is made. Plain mortise and tenon joints are used throughout and the parts are glued or pinned in place. The following material is required:

2½ in. sq. by 15 ft. for 4 corner posts, A;
4 in. by 15 ft., for top and bottom end rails, B, and top rail, C;
6¼ in. by 12 ft., for front and back seat rails, D, and E;
8¼ in. by 5 ft.,for two end pieces, F;
3 in. by 6 ft., for 4 back slats, G;
8⅝ in. by 3 ft., for 2 back slats, H;
1¼ in. by 3 ft., for 3 back slats, I;
5 in. by 13½ ft., for 2 bottom boards, J, and 2 end boards, L;
6 in. by 6 ft., for 3 cross boards, K;
(Excepting A the thickness of the above material is ¾ in.)
6¼ in. by ½ in., by 9½ ft., for remaining 2 bottom filler boards;
1 in. by 1 in. by 11 ft., for 2 seat cleats;
Green drill-backed imitation leather, 14 in. wide by 58 in. long;
Gimp; Tacks; Cotton and 2 doz. 1½ in. screws. —*Tud Garver.*

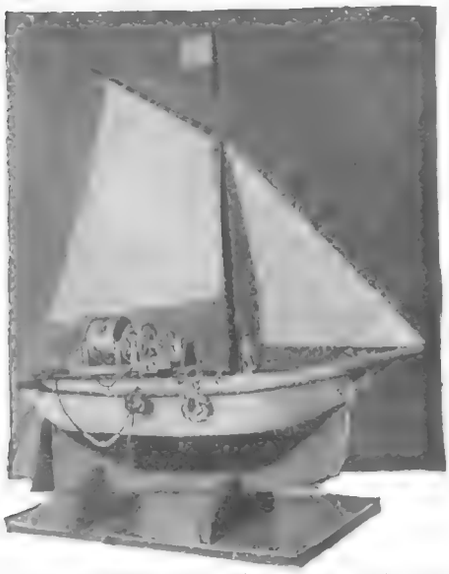
Power Driven Ice Cream Freezer

THE tedious work of making ice cream with a hand type of freezer can be eliminated by converting the freezer into a power type, using the system suggested in the illustration at the right. To do this, a long shaft is coupled to the regular freezer shaft and a 10 inch gear is fastened to the free end of the new shaft. This is then meshed with a 1½ inch gear, which is on a shaft driven by means of a 6 inch pulley; this is belted to a 2 inch pulley, driven by a ⅛-horsepower motor. By following these general details and providing suitable bearing and shaft supports, the results obtained will be most satisfactory. Of course, other methods of driving the freezer from an electric motor can be devised, but in any event, the gearing ratio must be such that the dasher in the freezer is turned at a comparatively low rate of speed. This is furthermore important in order that two great a load is not placed on the motor. Also, a chain drive can be substituted for the belt drive if desirable or more feasible. —*H. W. Secor*

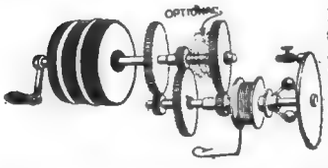

PINION GEAR 1½" DIA.
6" MEAN DIA. GROOVED PULLEY
GEAR 10" DIA.
⅜" DIA. ROUND LEATHER BELT
2 QT. ICE CREAM FREEZER
⅛ H.P. 110V. MOTOR
2" MEAN DIA. GROOVED PULLEY

HOW TO MAKE IT

AUTOMATIC FISHING BOAT

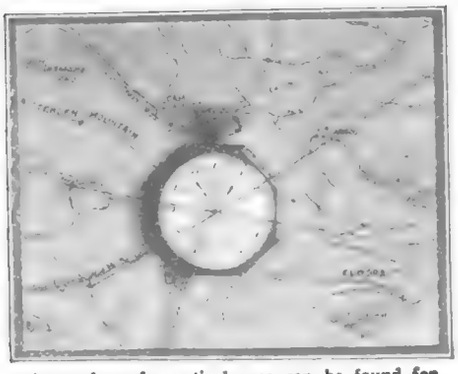


The model boat above carries a phonograph motor which automatically hauls in any fish which nibbles on the trigger line.

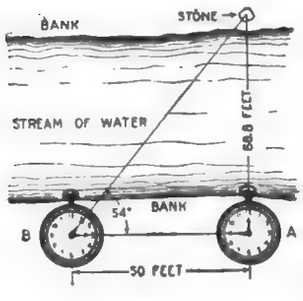


Motor is shown at left. Any sort of trigger release may be attached to the governor brake.—R. J. McHale.

TWO USES FOR YOUR WATCH

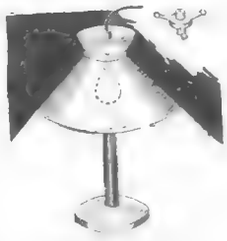


A number of practical uses can be found for your watch if you remember that each minute division on the dial represents an arc of 6 degrees. Its use as a protractor and direction indicator is shown by the photograph above. The arc between each two consecutive numbers equals 30°.—H. E. Benson.



With the aid of an elementary knowledge of trigonometry, the figures on a watch dial may be used to find out the distance across a stream. The Pythagorean hypothesis ($BC^2 = AC^2 + AB^2$) is used here.—Charles Rugler

NOVEL LAMP MOUNTING

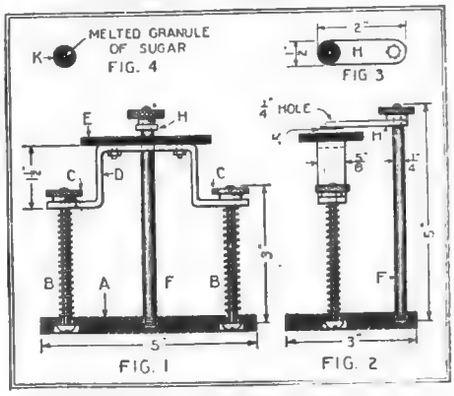


If the lamp is suspended within the shade by means of a three-arm disk as shown at the right, it may be easily removed and carried about. The disk is held in place by its own weight, but it may be modified so that it clips to the top of the shade.—J. T. Hurley.

USE FOR OLD INSULATORS

Telephone-wire glass insulator knobs pushed onto the legs of the kitchen chair will make it hard to tip over and more easily slid around. If the chair is made of soft wood, they may be screwed on.—J. R. Malloy, Rep. No. 12,257.

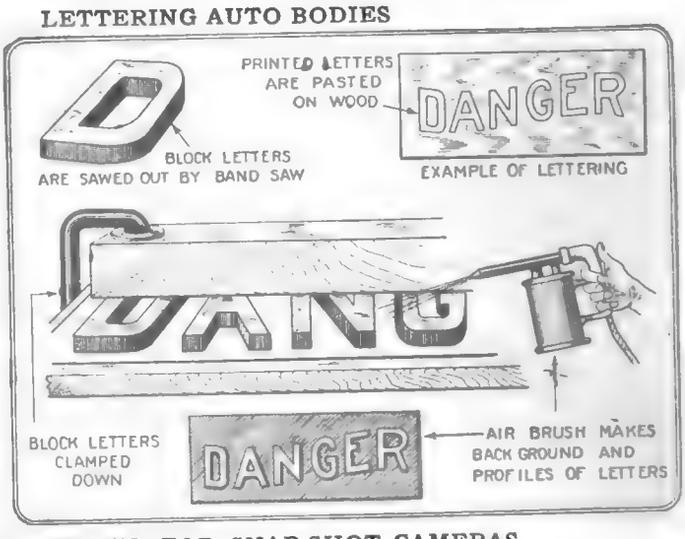
SMALL MICROSCOPE



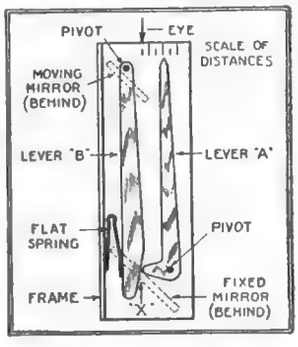
A magnification of 300 diameters may be obtained by the use of a melted sugar lens in the small microscope above. High illumination is necessary because of the very small size of the lens.—E. L. Richardson.

LETTERING AUTO BODIES

Printed letters are pasted on wood and cut out with a band saw. The letters are placed in proper position on the surface to be lettered and pressed down tightly. An air brush is used to lay in the background color. The use of an air brush rather than a paint brush, and the pressure exerted on the blocks, prevents the paint from intruding under them. When the block letters are removed, the background color originally painted on the body will show through the air brush coating. Inexpensive duplications are obviously simple.—G. A. Luers.

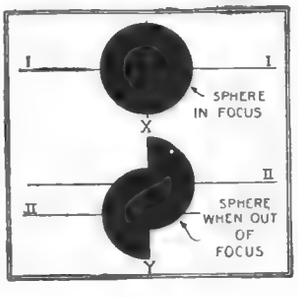

PRINTED LETTERS ARE PASTED ON WOOD
DANGER
BLOCK LETTERS ARE SAWED OUT BY BAND SAW
EXAMPLE OF LETTERING
BLOCK LETTERS CLAMPED DOWN
DANGER
AIR BRUSH MAKES BACK GROUND AND PROFILES OF LETTERS

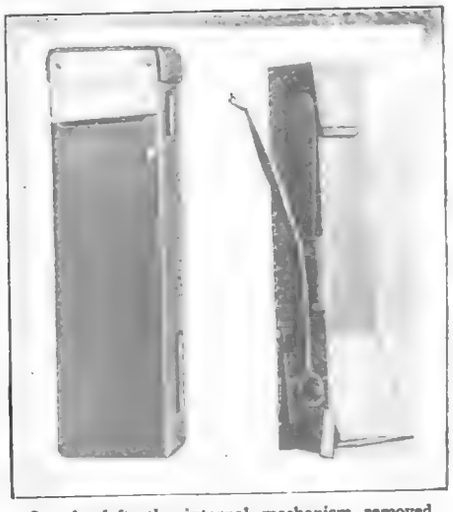
RANGE FINDER FOR SNAP-SHOT CAMERAS



The drawing to the left shows the series of levers which operate the mirror in the range finding device. The scale of distances may be easily seen in the photograph to the right and the relative positions of the rest of the mechanism located.

Using a new Kodak range finder, the observer focuses on a mirrored image. A circle seen out of focus appears bisected as at Y but when in focus, both halves register perfectly.



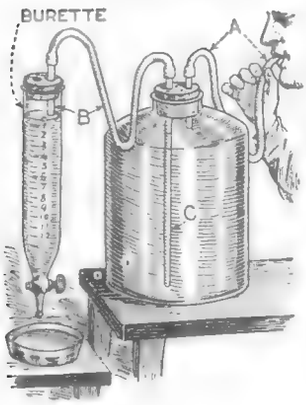


On the left, the internal mechanism removed from the casing, showing the two mirrors; on the right, the complete instrument, with the scale and indicating lever at the top. The operator looks through an opening at the top and perceives the image in the two mirrors.—C. A. Oldroyd, Rep. 4433.

WRINKLES
RECIPES & FORMULAS

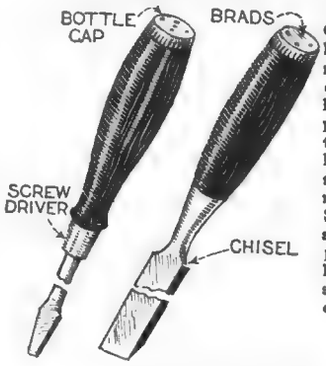
Edited by S. Gernsback

TO REFILL BURETTE



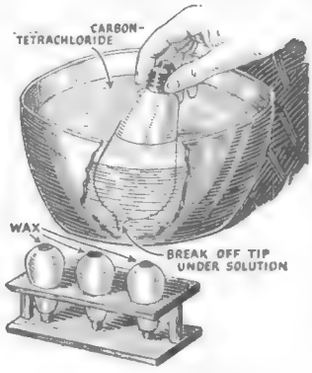
Blow in tube A until solution is above zero mark in the burette. Lower end of tube B is even with zero mark. Excess solution siphons back automatically into the stock jar. Tube C must always be partially submerged. — David N Roush, Rep. No. 1017.

USE FOR BOTTLE TOPS



Old crown cap bottle tops may be bradded to the handles of carpenter's tools to prevent the handle being split by hammering. Smooth down sharp edges to prevent cutting hands. — Wilson G. Walters, Rep. No. 6385.

FIRE EXTINGUISHERS



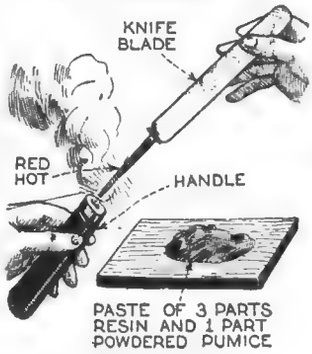
Old electric light bulbs filled by breaking off the tips in a bowl of carbon tetrachloride, make very effective fire extinguishers for home use. Breaking of bulb in flame releases chlorine which puts out the fire.— Dorothy J. Newbury.

FORKED BOTTLE OPENER

By cutting off two tines of a kitchen fork as shown in illustration, a very good crown cap remover may be made. The fork may be used for its usual purpose as shown at the right. — Juan Estolas.

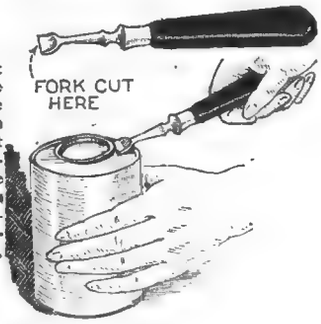
TO REPAIR KNIFE

Fill cavity in handle of kitchen knife with paste made of 3 parts resin and 1 part powdered pumice stone. Insert red hot prong of knife blade and it will stay put. —Nina Jeffers.

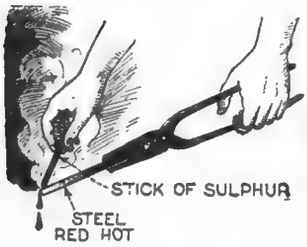


CAN COVER LIFTER

An old fork cut off at the base of the prongs makes an excellent tool for removing the covers from paint and varnish cans. — Wendell Rich.

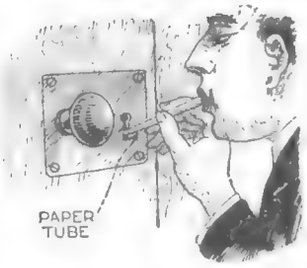


TO MELT STEEL



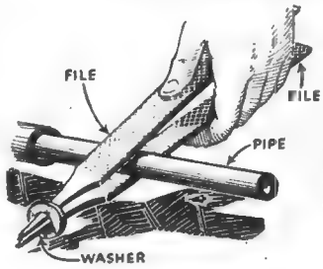
Touch a stick of sulphur to a red hot piece of steel and it will melt as easily as lead. Iron if heated white hot will act the same way.— Vernon Miller.

LUBRICATING LOCK



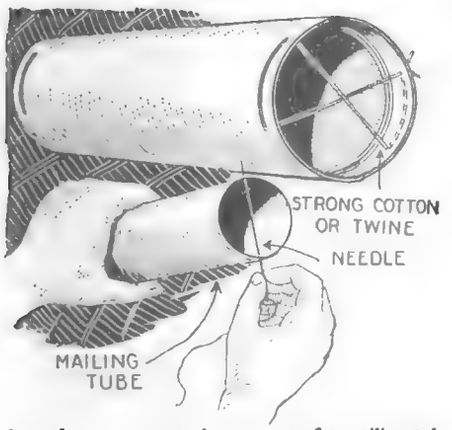
Graphite powder made from pencil leads if blown as shown, into a door lock, will lubricate it thoroughly. — Wendell Rich.

PIPE WRENCH



An efficient wrench for turning pipes may be improvised by fastening the handles of two flat files with a washer as shown.—H. W. Hepler.

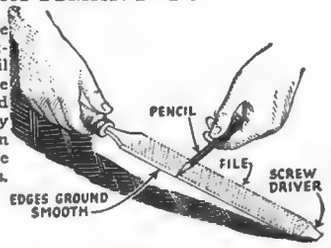
KEEP THEM IN



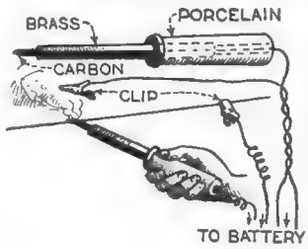
A good way to secure the contents of a mailing tube is to sew up the ends with two stitches as shown above.—Arthur A. Blumenfeld.

DRAFTSMAN'S TOOL

An old file makes an excellent pencil pointer for the draftsman and the end may be filed down to remove thumb tacks. — Leonard Keiser, Jr.

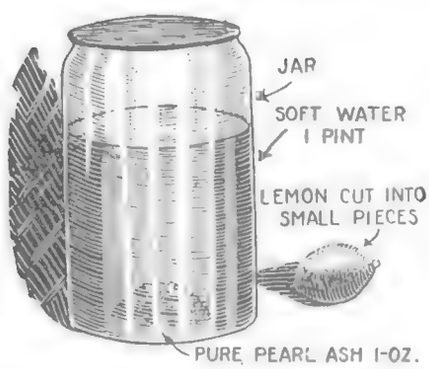


6-VOLT SOLDERING IRON

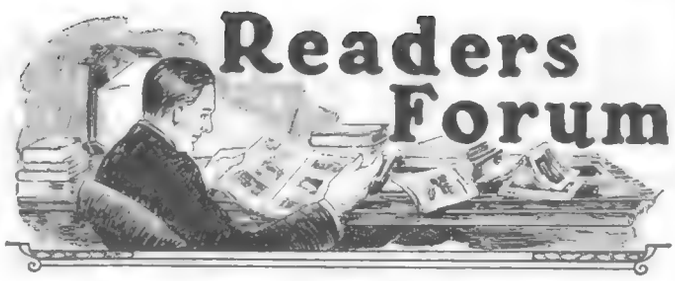


Carbon-tipped brass rod inserted into porcelain insulator makes efficient 6 volt contact soldering iron.—W. Codder.

GREASE REMOVER



Dissolve 1 oz. pure pearl ash in 1 pint salt water, add 1 lemon cut up small. Keep in warm place 2 days, strain and bottle. Saturate grease spots with liquid and wash out with clear water.—John H. Varley, Rep. No. 19629.



SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

CAN THE DEAD BE RE UNITED?

The Editor's recent article in SCIENCE AND INVENTION entitled *"Can the Dead be Re-United"* has been read and after mature reflection I am reluctant to take the writer seriously nor can I look upon it as a mere jest put forth for the purpose of bringing on controversy. He stated in substance that during the last 250,000 years ten trillions of human beings have lived and died on this earth, and the chance for one of that number to meet a particular friend in the hereafter was so remote that it would be just as easy as finding a lost needle in a haystack nine hundred feet high. In this same article, many other similies of a like nature were put forth, to show the absurdity of even thinking of a future union.

We go back to the front page of this same interesting Journal and we find advertised thereon a contrivance purporting to convey the human voice through the air across the United States without wires or speaking tubes. "Ye gods and little fishes"; can you expect us human beings up in this Northwest country to believe such fairy superstitious stuff? Eight years ago one of my professional friends from Minneapolis sneered and told me such was only "small town talk."

In view of the able article referred to in the Journal and judging by all the known rules of science, isn't that advertisement on the front page some huge joke the Journal is endeavoring to pander off on us in the name of truth? Pardon the satire; but do you for a moment Mr. Editor, think that I will believe you when you state that you can stand in New York within a closed building and speak to me while I am here eighteen hundred miles away? Why man, just think of the millions of human beings between us, think of the ten thousands of humming dynamos, millions of cattle, dogs, chickens, birds, wild beasts, existing between us making more or less noises. There are the noises of the ear splitting street car, the good, bad, and indifferent musicians by the thousands are grinding out noises. Yes, the listing winds, the growing plants, and the noise of the revolving earth itself is there to prevent you from throwing your voice eighteen hundred miles. Without considering the call of the crickets and the "bub" "dub" sounds of our own heart throbs there are existing right now—not only ten trillions of noises but quintillions of noises to interfere with your voice ever reaching my auricular appendages from that distance. It is preposterous, it is astounding. No gross superstition of the dark ages can equal that preposterous advertisement of the voice throwing. I write not so much in refutation of the editor's arguments, but to throw light on what some consider a dead subject but nevertheless which is a live wire.

Here for instance, is a man before us weighing 160 pounds, one who is insane with delirium. Multiply the 160 pounds by sixteen ounces and it gives us 2,560 ounces which we multiply by 480 minimums or grains which we find in an ounce and it gives us, 1,228,800 grains. Divide each grain into 500 parts and we have 614,400,000 parts. We take from our satchel one grain of Hyoscine and divide it into five hundred parts and we take only one of these five hundred parts, dissolve it in water and inject it under the skin of our delirous patient and wait a few minutes for results, when behold, the stormy wildness disappears and he becomes as quiet as a subdued virgin. To personify, one man was thrown into a crowd of 614,400,000 and almost instantly he put a quietus on all. This is an every day phenomenon. (*Your calculation is wrong.—Ed.*)

The great trouble with us when looking upon our own kind is to think of the form as the man, while the real man is an invisible being manifesting through the physical form. Without life and without the soul (Ego) the human form is nothing more than dead matter. There is underlying all things a formless primordial stuff which for convenience we call chaos, and which is moulded into shape by mind. Nothing can exist without first an idea, and as the idea (imagination) comes into existence it crystallizes the primordial substance into form. Some claim that this primordial substance is the negative side of Deity. Seeds of any kind are prepared forms waiting for the proper environment before life enters with the soul of the thing. A form can be living or dormant without being ensouled; but the moment the entity of soul enters it becomes animated, be it plant, animal, or man. Being of different vibration they interpenetrate each other as light may be said to interpenetrate air. Our philosophy may be as old as Democritus but it will stand all present tests.

For instance, here is a room dark and filled with air. Flood it with light and the air is still present. They interpenetrate. Another illustration, a new born baby-form comes upon the threshold lifeless. We instantly apply heat and cold and start artificial respiration chasing the fluids of that infant from one extremety to the other, drawing the air into its lungs and expelling it therefrom, but it remains a dead form all the while until the real Ego enters therein. At that very moment the soul becomes the light of the body and the baby begins to live, and cries out for air. (*Rather because of the air—Ed.*) The form must first be properly attuned before the Ego can enter.

Physical light is the Word (vibration) and it is no less than a direct manifestation of spiritual light be it from metal, man, or sun. Sunlight is the highest physical manifestation of the great Spiritual Light back of the sun. The spoken word coming from man is not man yet it cannot exist apart from him. It can be bottled up, so can the sun light as we find it in wood and coal. A ray of light coming from the sun is not the sun and yet we are unable to say that it is separated from the sun. Man, the entity is nothing apart from the great Spiritual Fire back of the physical fire. If the Ego withdraws from the body it is night within the body. If he withdraws with the mind and with the light and chemical ethers there enters death in the form.

The great Light or Spiritual Fire produces the idea and physical light comes, known to us as vibration and it exists in all things being much closer to us than our hands and feet, for it interpenetrates. The physical light cannot be present without the or its Spiritual Father for It emanates the idea producing the vibration.

The complexity of noises that can be produced on our musical keyboard of eight or nine octaves is beyond a life time's calculation—yet we can draw those numbers down to nine, then to four, and even down to one octave; which is as simple as the seven colors of the rainbow being drawn down to the three primary colors; red, yellow, and blue; and then narrowing these three down to the one great white light. (*White light is a combination of colors.—Ed.*) Nothing can exist without sound, for even the Ego of man individually has a sound peculiar to itself. By the laws governing sound we observe that it becomes a simple matter for the Individual (Ego) to reach any other soul in the solar universe by becoming attunded or en rapport with that soul. The re-union of discarnate souls is then one of the simplest things in nature.

W. STUART LEECH, M. D.,
Rosean, N. Mex.

(You may be absolutely correct in your statement to the effect that the union of discarnate souls is one of the simplest things in nature. On the other hand, you may be just as incorrect. The fact remains that we cannot prove that discarnate souls actually do unite. The theory that they do is not new and has been advanced by many illustrious writers, among whom we find Ella Wheeler Wilcox and many others. The possibility of the soul or any one in the spirit world communicating with terrestrial life may be sincerely questioned, and if we are to judge from the results which our Psychical Prize Contest has brought, we would add that the theory is absolutely untenable. For three years now, SCIENCE AND INVENTION Magazine has offered $11,000 for proof of spiritual manifestation, and for three years every medium who has been investigated has been proven fraudulent and has admitted his or her deceit. It will be remembered that the article by Mr. Gernsback was not intended to conflict with any form of religious teaching or worship. He, himself, gave arguments which, if they were held by the reader, completely negate other parts of the theory which he advanced.

Your statement to the effect that the three primary colors, red, blue and yellow can be narrowed down to one great white light is incorrect, inasmuch as a white light is composed of all the colors and is not a single color.

Were we to enter upon the metaphysical to an even greater extent, we could say that there is no such thing as color, because red is not red in a perfectly dark room; neither is that quality of pigment which we know as red of a reddish hue when illuminated with a blue-green light.

Your letter is very interesting from more than one standpoint, and we are glad to give it space in this department. We only wish we had room enough to publish more of the exceedingly interesting communications which are brought to us in the daily mail.—EDITOR).

AMAZING STORIES

THE new scientific fiction magazine, AMAZING STORIES, will be on the newsstands August 10th. Here is a magazine after your own heart. Readers of this magazine who have read the scientific fiction stories for years will welcome AMAZING STORIES with open arms.

The next issue of AMAZING STORIES contains, among others, the conclusion of the great radio novel "Station X"; the "Moon Hoax," the greatest scientific hoax ever published (1838) by a daily newspaper, an impressive story by H. G. Wells. A novel by Jules Verne commences in this issue, and also one by Garrett P. Serviss.

AMAZING STORIES has secured the sole rights to all of Jules Verne's stories, written by this, the greatest of all scientific fiction writers.

Be sure to get your copy today.

The magazine is edited by Hugo Gernsback.

PRICE 25c PER COPY.

LIFE BOATS FOR SUBMARINES

Editor, SCIENCE AND INVENTION:

In your recent edition of SCIENCE AND INVENTION you wrote an article on "Safety on Submarines" on pages 1082 and 1083. On the latter page you have a number of diagrams illustrating a theory advanced by an inventor E. R. Kimball. He has invented life-boats sealed and screwed tightly on the deck of submarines. In case the submarine should get out of commission and not be able to rise to the surface the sailors could get into these lifeboats, loosen them and be carried to the surface by the contained air. On the surface they could remove the top, start the motor and the crew would proceed in the boat to find assistance. However, if you will take the trouble to look in Jules Vernes' "Twenty Thousand Leagues Under the Sea you will find that Captain Nemo has just such a contrivance on his Nautilus, the only difference between Kimball's and Verne's idea being: 1. Kimball's boat was inverted; Verne's was not. Kimball's boat had a gasoline engine; Verne's had a collapsible mast and sails.

S. MELTZ,
Brooklyn, N. Y.

(And as the old adage goes, "There is nothing new under the sun." Nevertheless, there is a great difference between a theoretical idea of a fiction story-writer and the practical working of the same idea as designed by an engineer. Years ago, flying was advocated; today we think nothing of an airplane. We are now talking of television, of firing rockets to the moon, of tunneling the Atlantic Ocean or building a bridge across it, of being able to fly straight up into the air, hover over any point and land in an area not more than six feet in diameter, of leaving London after breakfast and having dinner in New York and various other impossibilities today, probabilities tomorrow and old things a few years hence. The idea of life boats for submarines was not original with Verne. Generally, ideas are developments. Few inventors take a rapid stride forward, breaking away from conventionalities and developing something absolutely new and fundamental. —EDITOR).

DISLIKES TORTURE METHODS

Editor SCIENCE AND INVENTION:

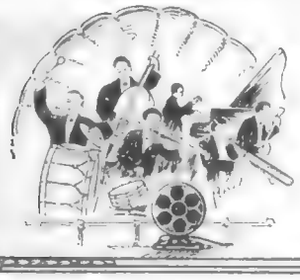
Being a scientific enthusiast, I have read nearly every scientific and mechanical magazine, also library books treating of scientific works, and how to make them, but I've found that there is no book equal to Science and Invention. One of your chapters is entitled "Ancient Torture Methods." Don't you think it would be rather morbid for a person to read such an article? But the worst of it is that a magazine containing such healthy and interesting articles as yours should dwell on that theme. Would it not be better to substitute for "Ancient Torture Methods" such wholesome articles as the rest of your book contains—David B. Levine, New York, N. Y.

(The last of the series of "Ancient Torture Methods" has been published and for the present there will be no more of these articles.—Editor.)

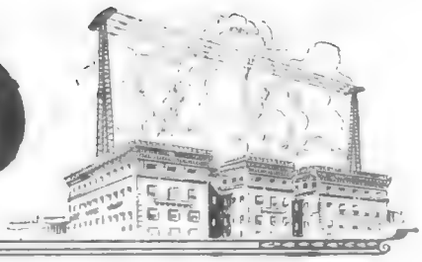
H. G. WELLS

the greatest living author of scientifiction, will be found every month, with one of his thrilling tales, in AMAZING STORIES. Be sure to get a copy of this amazing magazine.

AT ALL NEWSSTANDS



RADIO



Radio Control of Passenger Planes

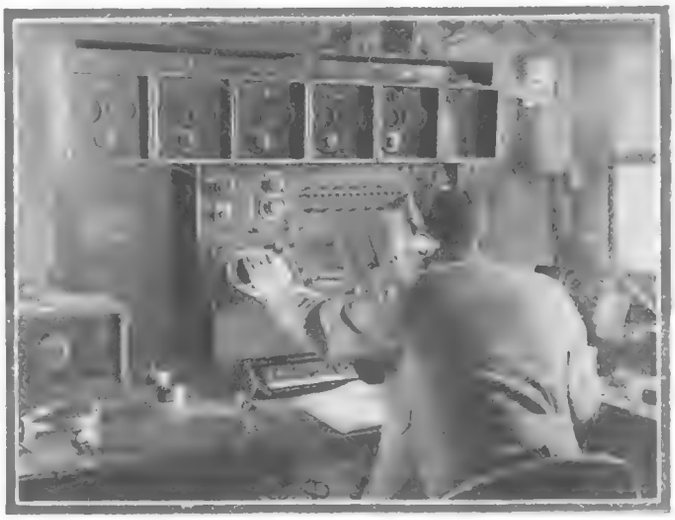
The photo on the left shows the aerials and radio cabins at Croyden, England, Airdrome of the Imperial Airways. This is the home port of the cross-channel planes.

At right, the radio telephone in use in the control tower at Croyden.

CONSIDERING the recent activity in commercial aviation and the realization of its possibilities shown by the American experts in the past year, it should be interesting to the reader to describe the methods of communication between planes used by one of the largest foreign companies, The Imperial Airways, Ltd., with headquarters at Croyden, a suburb of London, operates Continental air routes between Paris, Brussels, Amsterdam and other important cities, carrying passengers and freight at a very moderate rate. This company very soon found it necessary to provide some means of warning its pilots of bad weather conditions which they might unexpectedly run into with disastrous consequences. On the advice of the Air Ministry, they decided to equip each plane with a complete radiophone receiving and transmitting installation, and to provide means at the home field for keeping in constant communication with every plane. The weather reports are received at the control tower of the Croyden Airdrome by radio from the pilots of the planes, and from various observation posts throughout the continent. Here they are bulletined (see photo) for the benefit of outgoing pilots and passengers and are phoned to the planes in flight once every half hour. In the upper right-hand photograph the airdrome manager is shown reading a chart which has just been checked. He is giving the pilots instructions through his assistant whose microphone is connected direct to the broadcast transmitter shown in the lower right. Above the operator of the transmitting unit may be seen six separate panel units. Each one of these is a receiving set which is permanently tuned to the wavelength of one of the flying stations. The operator on duty at the central station is constantly on the watch for signals from the planes, which he relays through telephone lines to the control tower. In connection with this, it is interesting to note that a similar system of communication has been experimented with to some extent in this country for communication between moving railroad trains. While the system has never been developed to the point of great utility, we may soon expect to equal our English friends in communication efficiency, as laboratory tests have proven the idea quite feasible.

The Weather Report Board at the Croyden Airdrome is shown at left. Here British aviators before starting flight get detailed information on weather conditions in their path. Reports are also transmitted to the pilots in flight from the control tower every half hour using the apparatus shown in the photo at right

Transmitting apparatus used at the Airdrome for communication with planes in flight is shown at right. The pilots of the planes are in constant communication with the home field and with each other and receive reports from headquarters in exchange for hourly bulletins as to flying conditions in their area.



WRNY Celebrates Its First Birthday

By CHARLES D. ISAACSON

YES, thank you, WRNY is one year old and doing very nicely. WRNY had its birthday party and there were gay doings; you should have been there. In all probability you were—over the radio. I wonder if any of my readers stayed all through it. I myself was exhausted when it was over, but I danced to the last lingering dance, about two in the morning.

It was a great day: June the 12th, and WRNY just one year old. Grant Mitchell made the cleverest speech of the day. He came over from his successful play, "One of the Family," in which he is starring, to join the theatrical unit; there being units from every walk of life to pay respect to the station. Grant brought a present: it was a small child in a bathtub, and with it was a birthday card. Grant said he had a hard time procuring the right kind of card, because the card-seller did not know what sex a radio station is supposed to be. Grant declared that WRNY is a lusty baby in any event, and that probably the reason is that it is out in the air all the time!

Dr. Lee de Forest made the most complimentary speech. The father of radio broadcasting was present at the very birth of WRNY and has watched it through these trying months of its infancy. So he spoke with a great deal of godfatherly pride.

We began with a group of smart youngsters from the National Stage Children's Association, who had previously entertained the President at the White House. Then some of our leading authorities in the women's hour: Ruth Conne on Fashion, Mrs. Mary Fanton Roberts on Arts and Decoration, Mrs. Rose V. S. Berry on Painting and Sculpture, and so on down the long list—each took two or three minutes to administer just a capsule of thought and entertainment.

By noon we felt sufficiently educated, and a whole hour of the wildest, maddest, merriest, bluest and reddest popular and jazz music rent the air. Dr. de Forest was listening and I am wondering what he thought of his responsibility as the father of broadcasting. In any event the young folks, who adore this phase of WRNY's entertainment, sent in dozens of added requests. After luncheon, we returned for a matinee, in which a dozen of WRNY's finest ensembles came in for a fifteen-minute show. Talk about your continuous performances! Now it was grand opera; now it was an instrumental trio; now it was a real concert imported right from Carnegie Hall; now a little army of violinists playing in unison.

At twilight, the members of the Radio Theatre Players, having finished their own Saturday matinees, dashed over to WRNY with a lift in the form of a play "The Surprise." Olive Wyndham was the guest star, and James Durkin, a well-known director, was another guest. Well, from then on, it was a case of one celebrity after another.

(*Continued on page 462*)

MICHEL BARROY
Russian baritone, who has appeared with the Follies, is a frequent feature at WRNY.

MARIE TIFFANY
of the Metropolitan Opera Company, who sang for us lately over WRNY.

VIRGINIA HOWELL
Of "Alias the Deacon," whose charming Southern readings at WRNY are always welcome.

John Henry Titus
The nonagenarian author of "The Face on the Barroom Floor," recited it for us at WRNY.

OLIVE WYNDHAM
Now starring in South Africa, paid WRNY a visit the night before she sailed.

Wellington Cross
Of "No, No, Nanette," is now almost a permanent member of WRNY's staff of announcers.

Helen Wasserman
Of the Geon ensemble—not Irene Bordoni, as you may have thought from her vivacity.

David Putterman
Youngest of the cantors. You may have heard his fine voice in records, as well as over WRNY.

Louise Closser Hale
Novelist, and now "One of the Family," at WRNY as well as on the stage.

Sir Gilbert Parker
Canada's greatest novelist, was one of WRNY'S many celebrated visitors of late.

BERNICE HARDY
"Lady, Once-Upon-a-Time," has been taken from us by matrimony. She will live in Colorado.

Benjamino Riccio
Baritone, is one of the popular soloists who make so delightful the Edison Hour at WRNY.

EVA WELCHER
Of the Blockwell Trio, heads also her own string quartette. She is heard often at WRNY.

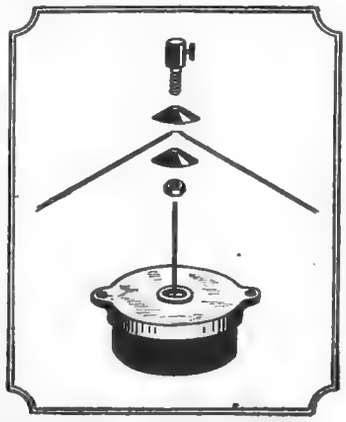
ISABELLE AUSTIN
Used to be of "Roxy's Gang," but has now one of her own at WRNY.

HARRY HERSHFIELD
Cartoonist, is shown here with his famous creation, Abie Kabibble. They entertained you recently from WRNY.

Home-Made Cone Speaker

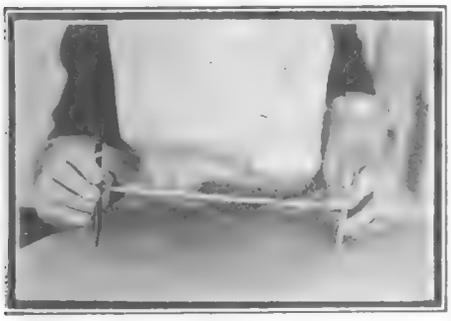
By HERBERT E. HAYDEN

THOSE who "roll their own" when it comes to radio sets surely will not stop at building their own cone type loud speaker, especially now since very excellent parts are available upon the market. The



An exploded view of the most essential parts of the cone type loud speaker is shown in the above diagram.

unit proper, of course, cannot readily be made by the average experimenter since it requires a great deal of mechanical skill and the use of precision machinery, to say nothing of engineering ability for the electrical and mechanical design of the instrument.



If a regular draftsman's compass with an extension beam is not available, the circle for the cone may be laid out by means of two pencils and a piece of string.

Cutting out the cone, however, and assembling the parts may be successfully done by the layman and affords an evening of genuine fun and real satisfaction as well as effecting a substantial saving in the price of the speaker.

The first step in the assembly is to describe

The unit is carefully mounted in place and should be accurately centered for the best results.

When completed, the speaker may be hung up on the wall in an inconspicuous place where it will be out of the way.

a circle of the proper diameter upon the parchment paper. The average man probably does not possess a draftsman's compass with an extension beam, and will therefore have to resort to some other means for making an accurate circle. Two pencils and a piece of string make a very good substitute for a compass. This scheme is shown in one of the photographs on this page. After the circle has been described, a sector is laid out, the exact size depending upon the size of the cone. After cutting away the sector the cone is formed and glued together along the edges formed by the removal of the sector.

The next step is to solder the connecting rod onto the diaphragm. In order to accomplish this the diaphragm is either scraped or sandpapered clean at the center. Great care must be taken not to bend the diaphragm at any point. The exact center of the dia-

A sector is cut out of the parchment sheet and the edges are then glued together preparatory to the formation of the cone. Only a good grade of glue should be employed.

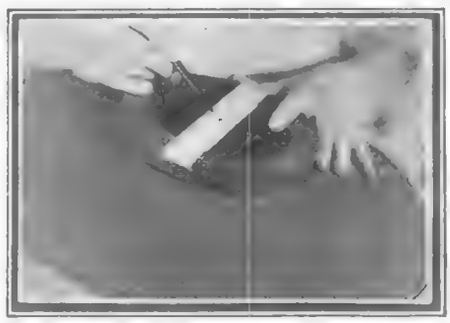
phragm is determined either by means of a combination square or by trial with a compass. The connecting rod is then placed in position and soldered on, care being taken that the rod is as nearly as possible perpendicular to the diaphragm. Only sufficient solder should be put on to firmly hold the rod in place. Too much solder loads the diaphragm unnecessarily and causes the speaker to reproduce poorly. The solder should be equally distributed around the connecting rod in order to avoid unbalancing the diaphragm.

The connecting rod bushing, the cone-shaped washers and the tightening nut are now mounted on the front cone and the supports for the unit on the rear cone. The two cones are accurately matched together and a strip of ornamental tape is put around the edges.

After the speaker has been completely assembled and the glue thoroughly dried, it is connected to the set for a test. The connecting rod is adjusted by means of the thumb screw on the sleeve until the best volume and quality are obtained.

The diaphragm of the speaker unit is scraped or sandpapered clean in the center and the connecting rod carefully soldered.

The horn type of speaker in its usual form must have a place to stand upon, and is, as a rule, placed on top of the receiving set. This often gives rise to a loud humming sound, caused by the mechanical vibration of the tubes. The remedy is to place



The hole in the cross bar through which the connecting rod passes should be accurately centered to avoid friction.

the speaker at some distance from the set. This practice generally makes necessary the addition of an extra table or stand for the horn. The cone speaker described in this article requires no place to stand upon. In fact, it may be conveniently suspended from a nail or hook in an inconspicuous spot on the wall. A design may be painted on the cone to add to its attractiveness.

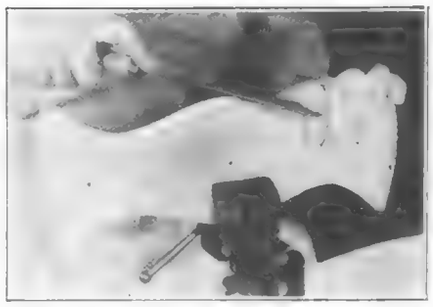
The completed cone is shown here suspended from a nail located in a convenient spot on the wall.

Building a Good Box Loop

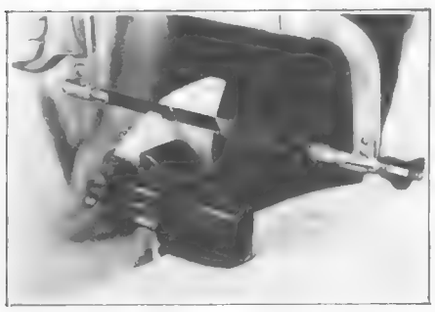
By HERBERT E. HAYDEN

The outline of the loop end is laid out on a smooth piece of ⅓" whitewood by marking around the edge of a template accurately cut to size from cardboard.

The end pieces are then cut out with a fret-saw. Be very careful to hold the blade of the saw vertical, and to follow the outline marking very accurately.



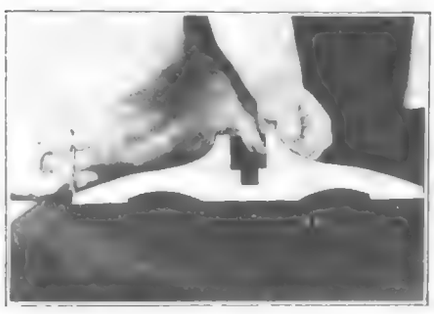
After the end pieces have been cut out, their edges may be trued up by the use of a flat wood-file. The markings for the notches and mounting holes are seen.



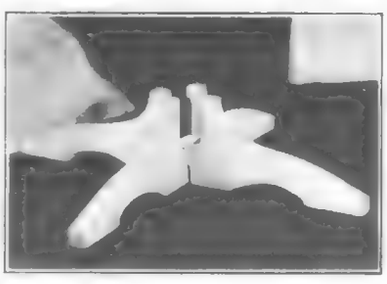
Place the end piece in a vise, being very careful not to dent the wood by too much pressure, and carefully cut out the notches.

Use a sharp knife to even up the notches so that the loop wire will not be damaged when threaded through them.

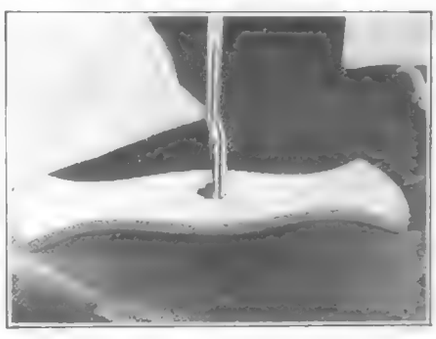
Three small holes are then drilled in the upper end piece to pass screws fastening it to the dowel sticks.



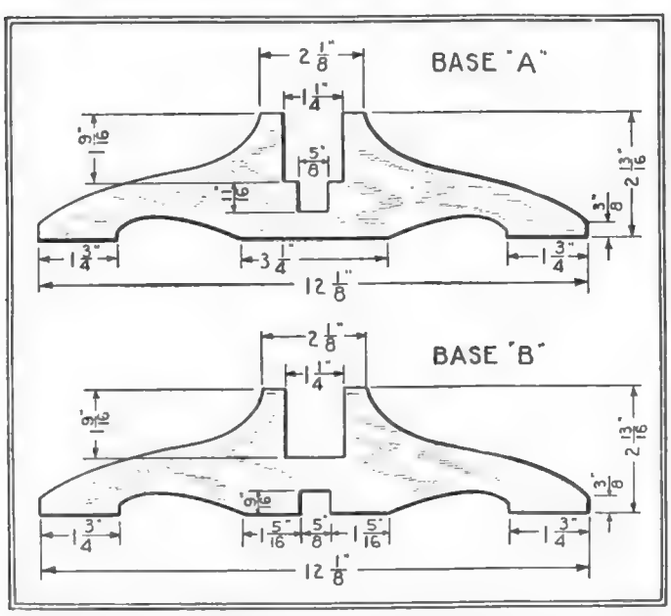
Templates are accurately drawn from the dimension sheet for the base members, their outline transferred to another piece of ⅓" whitewood and cut out as before.



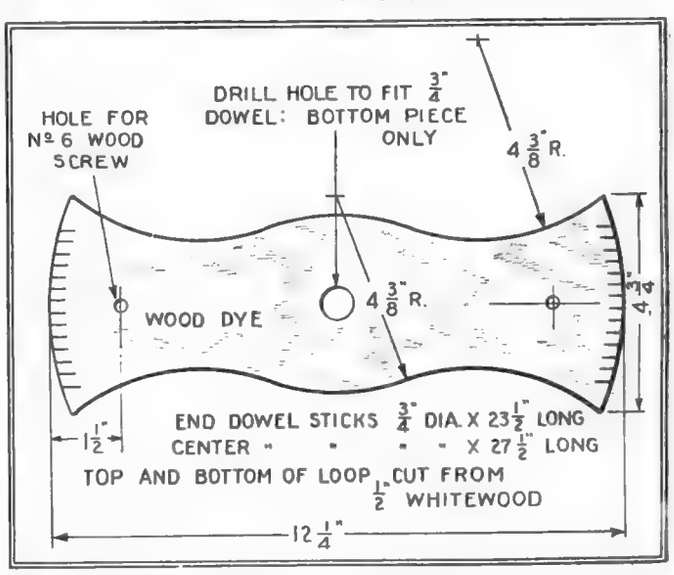
When both base members have been cut out and smoothed, it will be found that they fit together as shown above. It may be necessary to retrim the edges to obtain an accurate fit.



The two small screw holes and one ¾" hole to pass the center dowel stick are next drilled in the lower end piece. The center hole should be only slightly larger than the dowel.

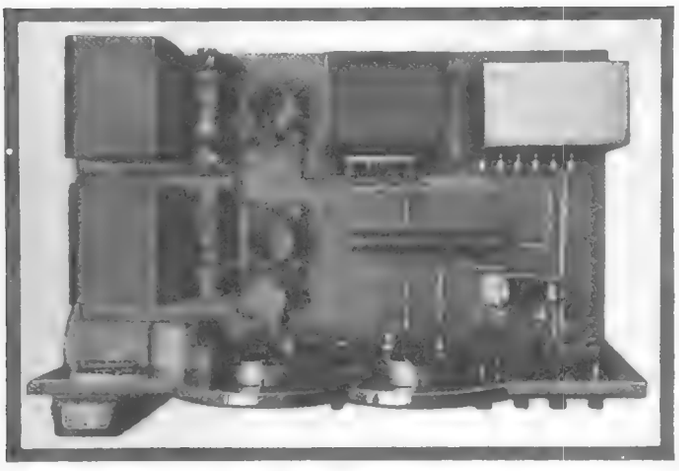


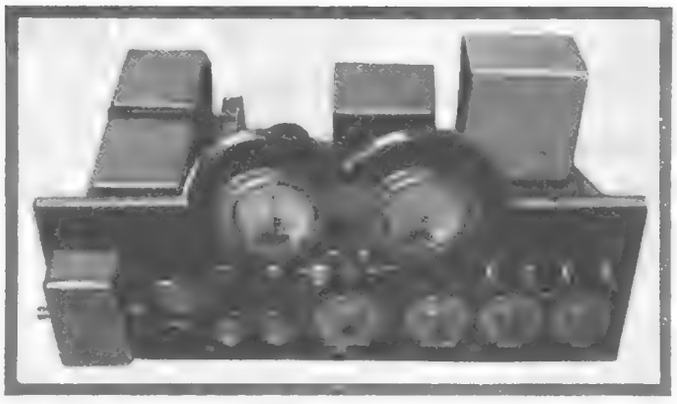
The drawings above should be very carefully followed, with the exact dimensions given. Lay out the cardboard templates full size.


DRILL HOLE TO FIT 3/4" DOWEL: BOTTOM PIECE ONLY
HOLE FOR Nº 6 WOOD SCREW
4 3/8" R.
WOOD DYE
4 3/8" R.
4 3/4"
END DOWEL STICKS 3/4" DIA. X 23 1/2" LONG
CENTER " " " " X 27 1/2" LONG
TOP AND BOTTOM OF LOOP 1/2" CUT FROM 1/2" WHITEWOOD
1 1/2"
12 1/4"

Both end pieces are constructed as shown above, the only difference being in the fact that the center hole of the upper is drilled just large enough to pass a No. 6 wood screw. Note that the radii of all curves used are given. The notches should be ¼" deep.

(*Continued on page* 477)





At left is a top view of the "B" eliminator which shows the positions on the condenser bank, transformer, chokes, and Raytheon tube sockets. Above may be seen the panel arrangement with meters and controls.

160 and 320 Volt "B" Eliminator

By A. P. PECK

THE "B" eliminator illustrated in these columns and constructed by Mr. L. A. Brams of Brooklyn, N. Y., proved to be such a success that it was greatly sought after by exhibitors at one of the recent radio shows for demonstration in their booths. This eliminator is one that is so versatile in character and is of such neat construction that the underlying ideas should appeal to everyone interested in radio from any angle whatsoever.

A few facts as to what this eliminator will do will not be amiss here. First, as will be noted from the photograph and diagram two Raytheon tubes (R) are used so that an extremely high voltage can be rectified. Then, variable resistances are available for controlling the out-put to the detector, the radio-frequency amplifiers, the audio-frequency amplifiers and for calibrating the voltmeter. Switches are incorporated so that high or low voltage outputs can be obtained. The milliammeter can be cut in or out of the circuit and the output voltage can be changed quickly and easily. Signal lamps are connected in the circuit to show whether high or low voltage is being supplied.

The power supply part of this "B" eliminator consists of two standard center tap transformers (T) of the type designed for use with the Raytheon tube. There are several of these on the market today, but those illustrated combine every desirable feature. They are small and compact and are completely encased in a metal box, which not only shields the coils but protects them from physical damage. Also very convenient soldering lugs are placed near the base of the instruments so that all wiring can be kept low and out of danger. These transformers are easily mounted, and are especially neat in appearance. Each one supplies current to a single Raytheon tube. Of course, .1 mf. fixed condensers (C) to take care of line surges must be shunted across the secondary. This is standard practice.

The outputs are wired to a particularly interesting multiple switch, which was specially constructed by Mr. Brams from standard practice. Probably by shopping around, a manufactured switch can be found that will do the work. It must, however, give the effect of three different switches. Two are to be of the single-pole, double-throw type, and the other of the single-pole, single-throw type. The single-pole, double-throw switches are so connected in the circuit as to enable the operator to change from high to low voltage output instantaneously. It will be noted that what this does is to place only one Raytheon tube in the circuit, or to connect both tubes in series so as to give a double output. It also controls the input. By using this system, voltage outputs of approximately 160 and 320 volts can be obtained.

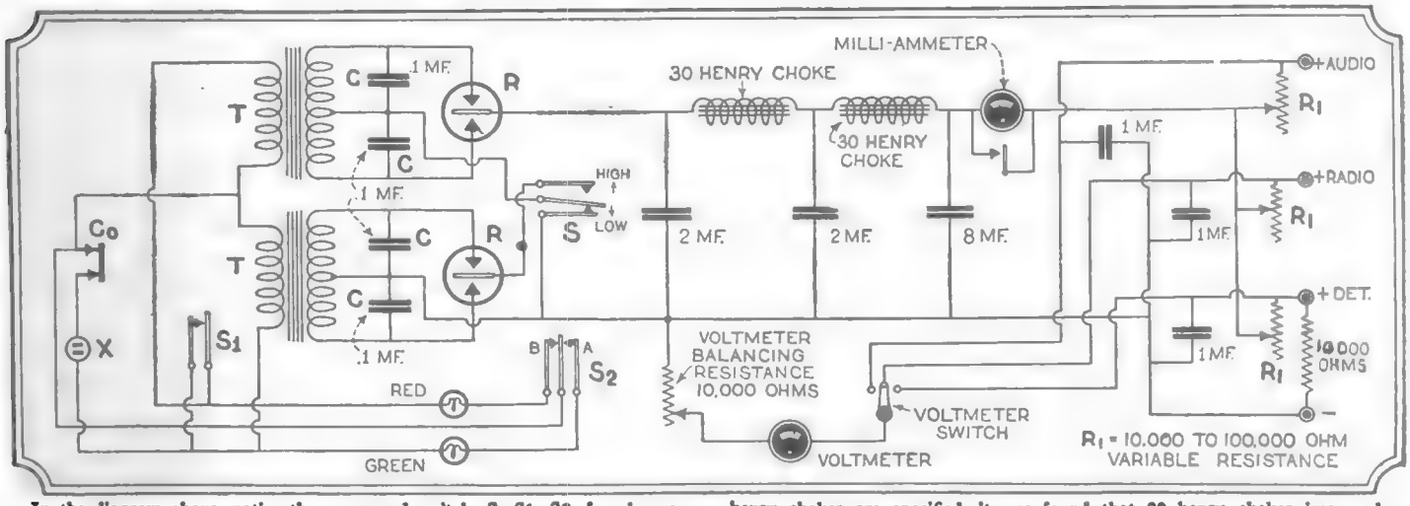
When switch S is in the low voltage position, switch S1 must be arranged so that its contacts will be open and S2 must be on contact A. When S is in the high voltage position, S1 must be closed and S2 on contact B. In front of the lamps controlled by S2 are green and red bull's eyes. When the green light shows, low voltage is being used, but when the red light shows, the power supply is being used for high voltage.

In building "B" eliminators it must be realized that high power is being dealt with, therefore, certain precautions must be taken, and one of the most important is in connection with the input circuit. It is a very good idea to use a circuit breaker in series with the 110-A.C. line and this is indicated by "CO" in the diagram. This instrument is now available on the market and is of a type that opens when a load of over 3 amperes acts upon it. Thus, if a short-circuit takes place anywhere in the eliminator, this circuit breaker will immediately open and prevent any damage being done to the "B" eliminator apparatus or to the house fuses. This circuit breaker is a decided advance in safety for "B" eliminators. It also acts as a line switch to turn the eliminator on and off.

On the front panel of the eliminator is mounted a standard electric light plug-receptacle. This is for easy and convenient connection to the house lighting circuit, and can be of any type ranging from the crude porcelain to the elaborate flush type plug receptacle. See X in diagram.

In order to determine just what current is being drawn by the complete receiver, Mr. Brams inserted a milliammeter in series with the high voltage amplifier lead. This milliammeter can be left in the circuit at all times if so desired. A voltmeter has also been incorporated, but this is rather a superfluous accessory for the average amateur, and need not be used. It is shown in the

(*Continued on page* 465)



In the diagram above, notice the compound switch, S, S1, S2, for change-over from low to high voltage. The voltage control resistances, R1, are an interesting feature and permit fine variation of output. Although 30 henry chokes are specified, it was found that 90 henry chokes improved the output quality. With the Raytheon tubes no hum is noticeable and better quality is obtained.

RADIO ORACLE

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

COMBINATION RECEIVER AND TRANSMITTER

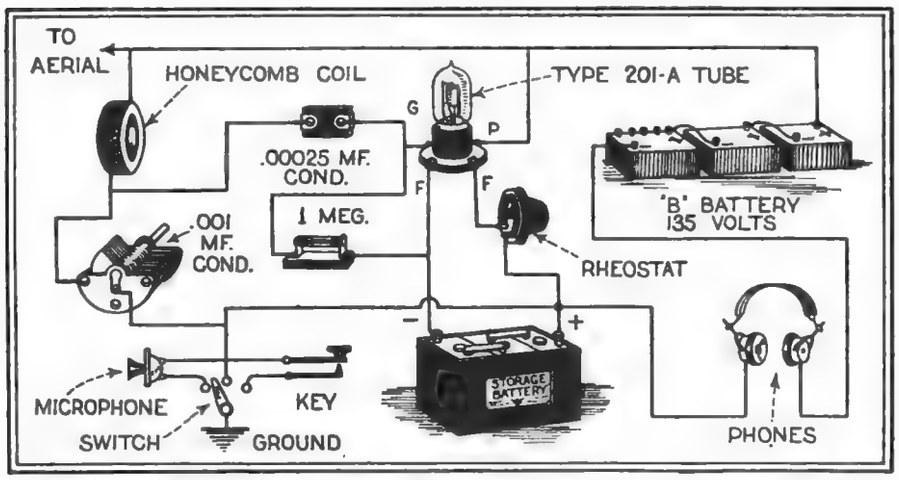
(495) Q. 1. Joseph S. Reed, High Point, N. C., desires a diagram of a simple low power combination receiver and transmitter.

A. 1. The circuit requested is given in these columns. A three-point switch is connected in the ground circuit to throw the set in position for receiving, transmitting by voice or transmitting by key. The tube used may be a 201A with 120 volts on the plate. The diagram shown is known as the Colpitts circuit.

A. F. TRANSFORMER RATIO

(498) Q. 1. Richard Wayne, Rochester, N. Y.: asks: In an audio-frequency amplifier, is it better to use a transformer having a 3 to 1 ratio in the first step and one having a 6 to 1 or 10 to 1 ratio in the second step or should both transformers have the same ratio?

A. 1. It is advisable to use the smaller ratio transformer in the second step rather than in the first stage. In order to avoid distortion, the ratios of both transformers should be as low as possible, consistent with good volume.



Q. 495. Picture diagram of a combination low power transmitter and receiver with three-way change-over switch for receiving, phone transmission and key. The circuit used in this set is the well known Colpitts.

"B" BATTERY SUPPLY

(496) Q. 1. Miss Eleanor Brown, Lancaster, Pa., asks advice as to the best method of supplying "B" battery current to her receiving set.

A. 1. The choice of the source of current supply for your set necessitates consideration of the efficiency of the several methods commonly used. First and most popular is the standard dry cell type of "B" battery. This type of current supply is the most efficient known, provided that the batteries used are of high quality. You must be sure that you are purchasing new batteries, because cells which have been standing on the dealer's shelves for any length of time are sources of much objectionable noise in the set due to chemical depreciation. Storage "B" batteries come next in order of efficiency, their only drawback lying in the fact that sulphated plates and poor inter-cell connections are liable to cause trouble. If you have direct current in your home it is comparatively simple to obtain a reliable and fairly quiet source of current. All that is necessary is some sort of approved protective device to protect the set in case of shorts and a well constructed filter system. It is quite possible to draw your supply from an A. C. line, too, but a transformer and rectifier are necessary to make the current usable for radio purposes.

"B" BATTERY TRANSMITTER

(499) Q. 1. James McGrath, Chicago, Ill., inquires: Are "B" battery transmitters such as that described in the October, 1925, issue of SCIENCE AND INVENTION Magazine practical for use on short waves?

A. 1. These transmitters are found to be entirely practical, particularly on the short waves, where almost incredible distances are covered with very low power input. For instance, one of our readers in South Africa built the transmitter described in the issue mentioned above and with it, he carries on constant communication with another transmitting amateur located 800 miles away! All of this is done with an ordinary receiving tube and 150 volts of "B" battery applied to the plate. Of course, there is not much QRM in this particular locality and where traffic is heavy, "B" battery operated transmitters cannot be expected to "push through." However, during periods when traffic is light, some exceptional results may be expected with this type of set.

VOLUME CONTROL

(500) Q. 1. Fred J. Simpson, Lincoln, Nebraska, wants to know: What are some of the methods for controlling the volume of a radio receiving set?

A. 1. One way to control the volume of a set is by detuning the set. This method is not very satisfactory in cases where several stations are broadcasting on approximately the same wave-length, since this would result in interference when the set is detuned from the resonance point.

Another method sometimes employed is to vary the filament current of the tube by means of the rheostats. The volume of the set may be controlled successfully in this manner, but the depreciation in quality is very marked when the filament current falls below a certain value. An efficient way to control the output of a set is to connect a variable resistance having a range of approximately from 10,000 to 100,000 ohms across the secondary of the first audio frequency transformer. This resistance absorbs power from the circuit and allows the output to be regulated to the desired value without causing distortion.

PUSH-PULL AMPLIFIER

(501) Q. 1. Willie Robert Jones, Shreveport, La., asks: Will the UV-199 type of tube work with push-pull transformers?

A. 1. UV-199s may be used quite successfully with push-pull transformers, although the same volume of sound should not be expected as with 201A tubes.

Q. 2. Do push-pull transformers amplify signals without distortion?

A. 2. The push-pull transformers go a long way toward eliminating distortion, especially in cases where the grids of the tubes are liable to become overloaded, if used with ordinary amplifying transformers.

Q. 3. Will a resistance coupled amplifier work satisfactorily with 90 volts on the plate?

A. 3. Owing to the high voltage drop across the coupling resistance, it is necessary to employ a higher "B" battery voltage with a resistance coupled amplifier than with one using transformer coupling. At least 135 volts of "B" battery should be used with a resistance coupled amplifier.

RAILROAD INTERFERENCE

(502) Q. 1. Alfred Martin, Akron, Ohio, states that whenever a train passes within the vicinity of his home, the signals which he is receiving on his radio set fade out and return after the train has gone by. He has observed that only signals coming from stations located in the same direction as the train fade out, while all other signals are practically constant in intensity. He wishes to know the reason for this.

A. 1. When a train or other large metallic object is situated between a broadcast station and a receiving set, the train absorbs a good deal of the energy which the radio set would otherwise pick up. If the train is sufficiently close to the receiving set, it may absorb so much of the radio energy, that practically none reaches the receiver. Signals coming from any other direction will not be affected to the same extent, since the receiver antennae intercepts the transmitted radio waves before they reach the train or other metallic body located in the vicinity of the set.

INCREASING TUNING RANGE

(503(Q. 1. J. W. Benson, Indianapolis, Ind., says: My tuned radio frequency receiver does not tune high enough. I believe the trouble lies in the fact that the variable condensers are too small. How can I increase the range without going to the expense of replacing the variable condensers?

A. 1. If a small fixed condenser is connected in each of the three tuning circuits as shown in the diagram, and so arranged that the three fixed condensers may be thrown into the circuit simultaneously by means of a switch, then you should experience no trouble in reaching the higher wavelengths. The capacity of each of the small fixed condensers should be about .001 mf.

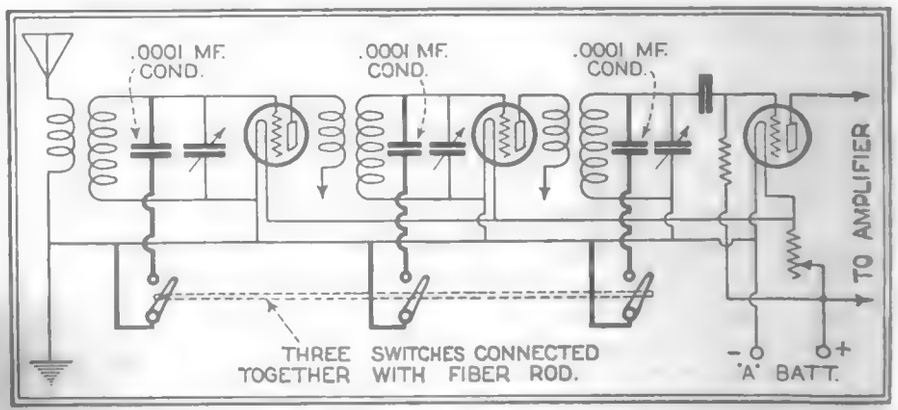
OSCILLATION

(497) Q. 1. Richard Langley, Hooker, Oklahoma, asks: In a three circuit tuner; what are the most obvious causes of too much oscillation? In other words, what causes a receiver to oscillate continually, it not being possible to stop the oscillations and use the receiver for broadcast reception?

A. 1. One of the most common causes of this effect, particularly in home-made receivers, is the employment of too many turns on the tickler coil. The remedy is obvious; remove sufficient turns to cause the receiver to operate correctly as a regenerative set but not to squeal. This should be done with the receiver tuned to the highest wavelength, which it is desired to receive. Ten turns on the tickler is often found sufficient for a coupler covering the broadcast wave-length.

Another cause of self-oscillation over the entire range is long grid leads and plate leads that are run parallel to each other. Remedy: separate the leads or run them at angles to each other. Also have grid and plate leads as short as possible.

Sometimes the addition of a by-pass condenser across the output of the detector circuit will aid considerably in controlling a continuously [illegible] lating receiver. Also try adjusting the [illegible] the detector tube rheostat and varying [illegible] voltage applied to the detector tube [illegible] tubes may be of further assistance.



Q. 503. A method of increasing tuning range of radio frequency receiver by shunting small fixed condensers across secondary variable condensers of radio frequency stages.

Scientific Humor

DON'T KNOW—100% CORRECT

An extremely valuable football player had been conditioned for poor grades and was told that he would have to get a passing grade of 50 in chemistry in order to play in an important game. The Professor of Chemistry, who was an ardent fan, said that he would give the student an oral examination and later, announced that he had passed with a grade of 50. When asked what the questions were, the Professor said: "I asked him what color Venetian Red was and he said 'Blue' and he was wrong. I asked him what color Yellow Ochre was and he said he didn't know, and he was right, so I gave him 50 for the exam.—*Miss Mabel Overholt.*

STEPPING ON IT

Girl: "Father, look, there is a bug on the ceiling!"

Absent-Minded Professor: "Well, step on it and don't bother me any more.—*Harry Davis, Rep. No.* 24447.

NO GRASS ON A BILLIARD BALL

Little Anna asked her father why he didn't have any hair on top of his head.

He answered, "For the same reason that grass won't grow on a busy street. You know why now, don't you?"

"Sure," she replied, "it can't get up through the concrete."—*Mrs. C. A. Hardesty.*

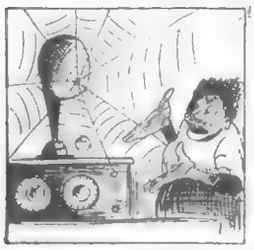
HE CALLED IT A RUBYIAT

Professor of Literature (who is handling a radio set): "I want a rheostat, thirty Khayyams resistance."

Clerk: "You mean thirty ohms, don't you?"

Professor: "That's right. I knew it was either ohm or Khayyam.—*W. W. Hatfield.*

SPIDER WEB COILS



"Bridget, what did you leave those cobwebs around the radio for?"

"Sure and I thought they was a part of it, Sor."—*Alfred Bogan.*

FITS ANYTHING

First Musician: "What key are you playing in?"

Second Ditto: "Skeleton key.

First Musician: "Skeleton Key?"

Second Ditto: "Sure. Fits anything."—*Edward Niczkowski.*

ETHER MORE OR LESS

"You know, Tom, I think there's only one song appropriate for Radio Broadcasting."

"Which song is that, Fred?"

"Over the Waves."—*Ernest Rinn, Reporter No.* 11908.

SOME ARE JUST AS GOOD

Radio Fan: "Give me a wave trap, quick, I want to catch a street car."

Clerk: "Sorry, sir, you can't use them for that."—*Ernest Rinn, Reporter No.* 11908.

First Prize $3.00

MANY A ONE WE'VE BLOWN OUT!

To Radio Editor:

How can I put out the lights in my radio? I've heard of people blowing out their tubes, but I don't see how it's possible.

(Signed) Anxious.

—*Herbert Krause.*

ROUGH STUFF ON TOUGH

There was a young chemistry tough
Who insisted on mixing some stuff,
Then heated the vial
And after a while
They found his front teeth and a cuff.

—*H. S. Postgate, Reporter No.* 26469.

We receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

AND ROSE AGAIN

Prof. to Physic Students: "Now, who broke the barometer?"

No response from students.

Prof.: "I want to know how this barometer was broken."

Feeble-Minded Student: "Didn't you say the barometer fell this morning?"—*Raymond C. Johnson.*

A DIRTY DIG

Wife: "Come, let's get down to brass tacks and thrash this thing out.

Hubby: "No, we'll use ten penny nails. It's easier to see the point with them!"—*Henry A. Courtney.*

ON EARTH OR IN HEAVEN?

Old Lady: "Are you sure that this century plant will bloom in 100 years?"

Florist: "Certainly, ma'am. If it doesn't, bring it back and your money will be returned."

—*R. Smith.*

ANOTHER TWINKLE, TWINKLE, LITTLE STAR

Scintillate, scintillate, luminous constellation!
Interrogatively and inquiringly do I question your constituent elements
In your prodigious altitude above the terrestrial sphere,
Similar to crystalline carbon suspended in the celestial firmament.

—*A. Leventhal.*

ANTE MORTEM

"Fancy old Bill, of all people, going into the gunpowder shed with a lighted candle!" remarked the proprietor of the explosive factory to his foreman. "I should have tho't that would have been the last thing he'd do."

"Which, properly speaking, it was, Sir!" replied the foreman.—*H. S. Postgate, Reporter No.* 26469.

THE TRUE ORIGIN

Professor: "Smith, what is the composition of water?"

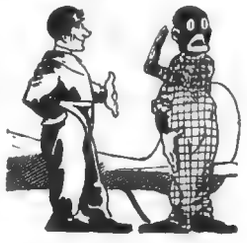
Smith: "Water is composed of two gins, oxygin and hydrogin. Oxygin is pure gin; hydrogin is gin and water.—*J. Richardson, Reporter No.* 26535.

WAS TRUSSED UP

"Arthur, I don't think you understand the word engineer," said the teacher. "So try and give a sentence using it."

Arthur replied, "Was the engineer the bridge when the accident happened?"—*Irving Callahan.*

FIRM TERROR



Aviator (to colored man): "How would you like to have a ride?"

Colored Man: "No, sah; I stays on terrah firmah and the more firmah the less terrah."—*Wilbur Holland.*

VERY PRACTICAL

Professor: "Give me a practical application of the 'right hand rule.'"

Stude: "To find the direction of the current in the third rail grasp it with your right hand so that the fingers are curved in the direction of the lines of force, and your thumb will point in the direction the current is flowing."—*Frank Schmulowitz.*

ANOTHER USE FOR THEM .....

Grandma greeting grandpa as he enters the house with a loud speaker under his arm.

"Why Pa, I won't let you go around the streets with that thing sticking in your ear even though you are deaf."—*F. Ebel.*

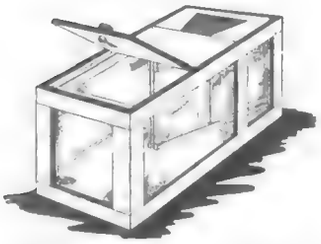
TEN THOUSAND TIMES MORE

"Pop," inquired little Clarence Lilywhite, "what am a millenium?"

"Sho!" said the parent, "doan' yo' know what a millenium am, chile? It's jes' about the same as a centennial, on'y it's got mo' legs."—*Alma Severcid.*

LATEST PATENTS

ROACH TRAP

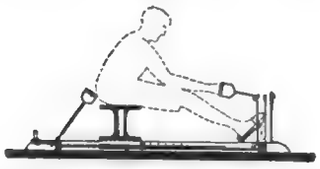


No. 1,578,061 issued to Jacques Abadie. This trap utilizes the knowledge that a roach prefers an opening only slightly larger than his body to one much larger. The bait is placed in a screened, covered box which is entered through a wedge-shaped passageway containing slots of various widths. The roach, attracted by the bait, chooses the slot most suitable to its size, enters the box and is unable to find the way out.

MILK BOTTLE OPENER AND CAP

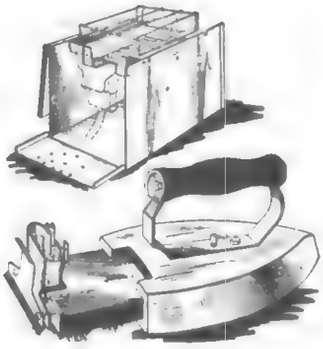
No. 1,575,319 issued to Ryk Cruyff. This invention consists of a cap of aluminum or other light metal which, when fitted over the top of an unopened milk bottle, bears a cutting blade which punctures the paper cap and on being turned, cuts it away. The aluminum cap may be used as a cover for the contents after the bottle has been opened.

EXERCISING APPARATUS



No. 1,577,809 issued to Edward T. Randall. This apparatus incorporates many of the features found in expensive gymnasium equipment. A sliding seat permits its use as a rowing machine, and means are provided for the use of coil spring exercisers and Whitley cable exercisers.

HEATER-COOKER-IRONER

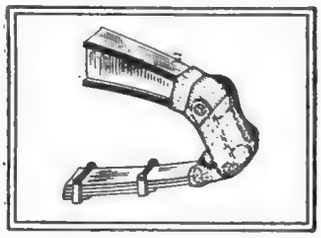


No. 1,580,909 issued to Joseph Lavoie. This invention relates to a self-contained electric radiant heating unit which is usuable in a variety of ways. A rack is contained in the carrying case, shown in the upper half of the illustration, which permits the heating unit to be used for toasting bread or as a small electric stove. A sadiron is provided which contains a receptacle for the heating unit, forming a very efficient electric iron. The apparatus is so arranged that it may be telescoped and packed within the limits of a light metal packing case which is provided. The device is very compact when packed, and should make a handy unit for the traveler.

VANITY CASE

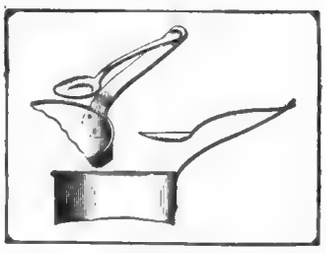
No. 1,580,369 issued to George T. Bates. The latest thing in the way of portable beauty shops is shown above. The metal case contains in one of its halves a firmly cemented glass mirror, the other half containing receptacles for loose powder, rouge compact, two puffs and lipstick. As may be seen above, the cover of the pocket containing the rouge compact is so arranged that, when closed, it holds the lipstick in place. The loose powder is covered by an adjustable sifter-top, which in one position is sealed and will not permit the escape of powder.

SHACKLE COVER



No. 1,574,898 issued to Jason A. H. Johnson. This invention relates to a cover for spring shackles on automobiles. It consists of a boot of leather or similar material, which is laced about the spring ends and shackle bolts and protects the moving parts of the spring assembly from the intrusion of injurious dust and grit. A cover applied in this fashion also functions to prevent the leakage of grease from the spring leaves.

SPOON-SUPPORTING MEANS

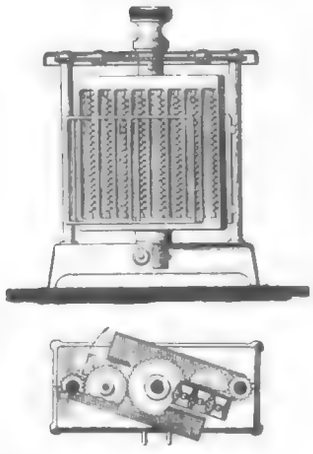


No. 1,580,582 issued to Alvin E. Carman. A simple slot cut in the end of the handle of a kitchen utensil acts as a receptacle for the handle of a mixing spoon and keeps the spoon out of the way of the utensil cover and prevents its becoming overheated.

SANITARY CONTAINER

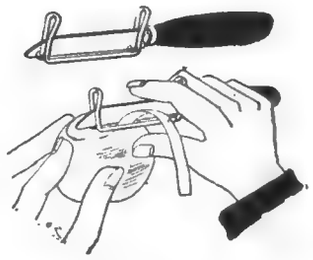
No. 1,584,261 issued to Alphonso Vuolo. A novel sanitary holder for tooth brushes, nail brushes, tooth-paste tubes, etc., has been invented in the form shown at the right. The container is so arranged that each article is kept in a separate compartment and is prevented from falling out by a flange at the bottom of the receptacle, which forces the article to take the position shown in the drawing. Evaporation is permitted through ventilating holes in the sides of the container, and the top is so constructed that dust is prevented from settling upon the contents. A ring is provided attached to the cap for suspension from a hook.

ELECTRIC TOASTER



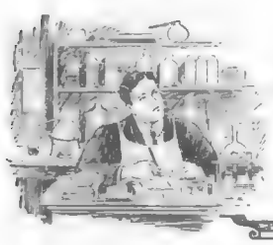
No. 1,580,244 issued to Albert Guissart and Edgar H. Barge. The toaster illustrated below incorporates two novelties in design: first, the method of automatically turning the toast without removing it from the holder; second, a self-operated switch which cuts off the current when the holder arms are not in a position for toasting. Turning the knob at the top of the toaster rotates the holder arms so that they change positions and also disconnects the apparatus from the power line when the arms are half rotated.

KNIFE GUARD



No. 1,578,295 issued to Virgil D. Swihart. Here is a device which will make it possible to assign hubby to K. P. duty as official potato-parer without fear of his using up all the potatoes in paring. The wire clip which is made of spring steel fits over the blade of the paring knife and may be adjusted so that strips of any thickness desired may be cut from the vegetable or fruit. The principle on which this operates is practically identical to that incorporated in the design of Gilette and other types of safety razors, but we do not by any means recommend that this apparatus be used to remove hirsute adornment. Try it if you must, but remember that we have no First Aid column.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.



THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

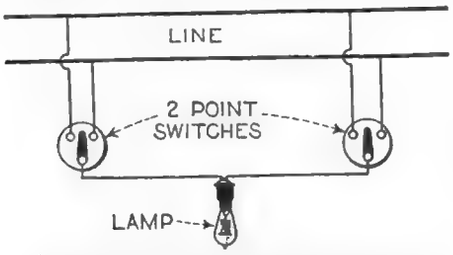
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

TWO-WAY LIGHT CONTROL

(2104) Q. 1. James A. Broadston, Cincinnati, Ohio, says: In many halls there is a light controlled by two push-buttons so that it is possible to turn the light on or off from either button, regardless of the position of the other. Please publish the wiring diagram of such an arrangement.

A. 1. The diagram you request is given in these columns.

Q. 2. When a friction clutch begins to take hold, there is a certain amount of friction. When the clutch is fully engaged, there is no friction and also when it is disengaged, there is none. Please explain how the friction varies when the clutch is thrown in.



Q. 2104. This method of connection permits a light to be operated from two points.

A. 2. When the clutch is in the disengaged position, the slippage may be regarded as infinite and the friction between the two parts of the clutch is zero. As the clutch engages, the friction increases from zero as the pressure and difference of rotary speed increases up to a maximum. As the difference of speed grows less the latter condition occurs practically when the two parts of the clutch are rotating at the same speed and there is no slippage between them. When the clutch begins to disengage, the friction between the two parts decreases, and slipping increases and friction decreases until the clutch is entirely disengaged.

RAPIDITY OF FREEZING

(2105) Q. 1. F. L. Stetzer, Weehauken, N. J., wants to know: If two pans of water of the same size are put into a room at freezing temperature, the water in one pan being at the boiling point and the water in the other pan at a temperature of 80° Fahrenheit, which pan of water will be the first to freeze?

A. 1. The water at the boiling point contains the greater amount of heat and it will therefore take longer for the heat to diffuse itself into the air of the room. Consequently the water at the higher temperature will not freeze as quickly as the water at the lower temperature.

WATCH DEMAGNETIZER

(2106) Q. 1. Russell F. Waterman, Columbus, Ohio, writes that his watch has become accidentally magnetized due to the fact that it has been within the magnetic field of a large generator and no longer keeps good time. He desires to know how the watch may be demagnetized and brought back to its normal state.

A. 1. A watch demagnetizer can be made by winding 50 turns of No. 22 D.C.C. wire on a cardboard tube 4 inches in diameter. This winding is connected in series with an ordinary 60 watt lamp on the 110 A.C. line.

By inserting the watch and pulling it out a few times, you will be able to completely demagnetize it.

THERMIT PROCESS

(2107) Q. 1. Vinagradoft, Scotia, Calif., wishes to know the proportions of the chemicals used in the Thermit process of welding and the chemical reaction which takes place.

A. 1. The Thermit process is based upon the heat produced by the oxidation of aluminum by a metallic oxide. In welding iron the proportions used for the Thermit mixture are 3 parts of iron oxide, Fe_3O_4, and 1 part of aluminum powder. When the mixture is ignited, the aluminum combines with the oxygen in the iron oxide, liberating free iron in a molten state, the temperature of the reaction often reaching as high as 5400° Fahrenheit.

RENEWING OLD FILES

(2108) Q. 1. Richard Dietrich, Rochester, N. Y., states that he has several old files which are almost worn out and would like to know how they can be treated to restore their cutting surface.

A. 1. Old files may be rendered useful again by the following process: Boil them in a potash bath, brush with a hard brush and wipe off. Plunge for half a minute into nitric acid, and pass over a cloth stretched tightly on a flat piece of wood. The effect will be that the acid remains in the grooves, and will take away the steel without attacking the top, which has been wiped dry. The operation may be repeated according to the depth to be obtained. Before using the files thus treated, they should be rinsed in water and dried.

Q. 2. How can cloth be treated to make it fire-proof?

A. 2. The cloth should be dipped in a solution consisting of 10 to 20 parts of potassium carbonate and 4 to 8 parts of ammonium borate in 100 parts of water. When thus applied the liquid covers the material with a glassy mass and if it should come in contact with fire, carbon dioxide gas is given off, preventing burning.

Q. 3. How is decalcomania paper made?

A. 3. Smooth unsized paper, not too thick, is coated with the following solutions:

I. Gelatin, 10 parts, dissolved in 300 parts warm water. This solution is applied with a sponge. The paper should be dried flat.

II. Starch, 50 parts; gum tragacanth, dissolved in 600 parts of water. (The gum tragacanth is soaked in 300 parts of water; in the other 300 parts the starch is boiled to a paste; the two are then poured together and boiled.) The dried paper is brushed with this paste uniformly, a fairly thick coat being applied. The paper is then allowed to dry again.

III. One part blood albumen is soaked in 3 parts water for 24 hours. A small quantity of sal ammoniac is added.

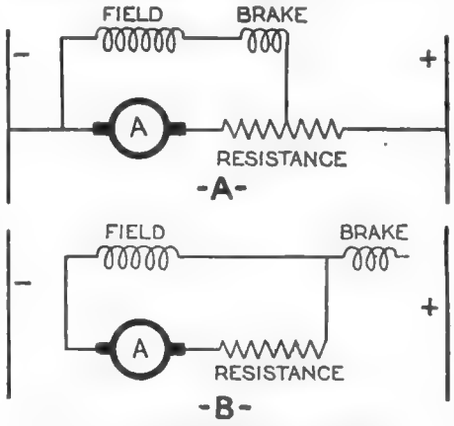
The paper, after having been coated with these three solutions and dried, is run through the printing press, the picture, however, being printed reversed so that it may appear in its true position when transferred. Any colored inks may be used.

DYNAMIC BRAKING

(2109) Q. 1. Raymond V. Hatton, St. Louis, Mo., asks: What is meant by dynamic braking of an electric motor and how is this accomplished?

A. 1. When it is desired to bring motors to rest quickly, or in the case of crane or hoist motors to hold the load after having raised it, they are supplied with brakes. Braking may be accomplished in two ways, namely, mechanical braking and dynamic braking.

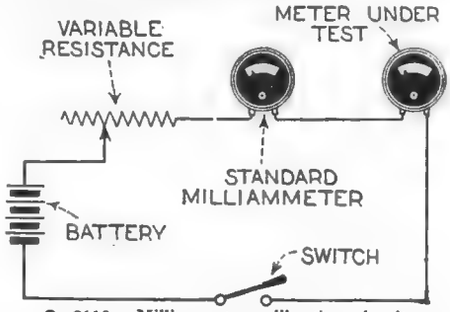
Dynamic braking is accomplished by connecting the motor to operate as a generator for delivering energy to some local circuit or returning it to the supply circuit, which action retards the motor. When it is necessary for the machine to hold its load, dynamic braking is supplemented by friction brakes which become operative when the motor comes to rest and the dynamic braking ceases. In applying dynamic braking to series-wound motors the field winding is usually first connected in series with a resistance across the line wires to insure the motor building up as a series generator, and thereafter the motor is disconnected from the line, leaving the motor armature and field in circuit with the resistance in the diagram. These connections are shown respectively at a and b.



Q. 2109. Circuit diagram for dynamic braking system for electric motors.

CALIBRATING MILLIAMMETER

(2110) Q. 1. Murray Farmer, Norwood, New York, asks: How can an ordinary ammeter be converted into a milliammeter?



Q. 2110. Milliammeter calibrating circuit.

A. 1. An ammeter, if it is of the type having a shunt across the movable coil may be converted into a milliammeter by removing the shunt and recalibrating the instrument in comparison with a standard milliammeter. The connections for the recalibration test are shown in these columns.

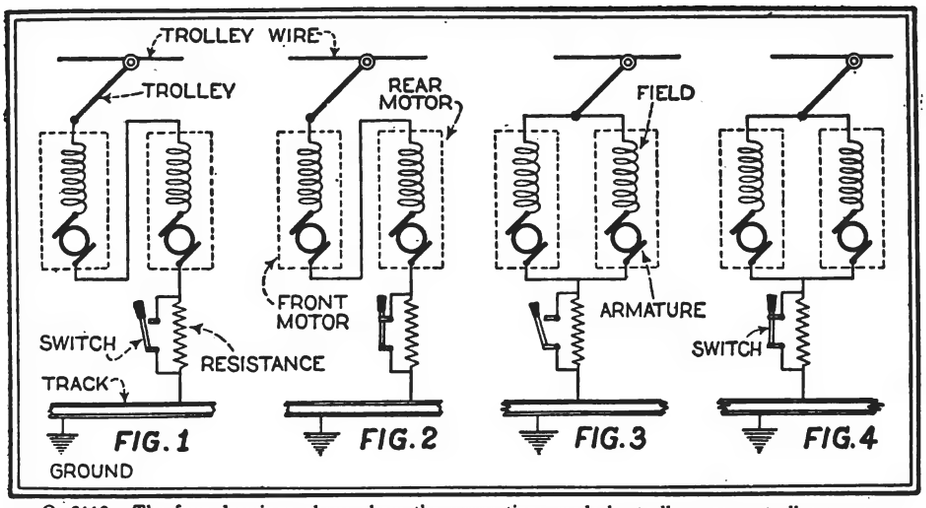
DEFINITION OF SHORT CIRCUIT

2111) Q. 1. James B. Larson, Indianapolis, Ind., asks: What is a short circuit?

A. 1. The term "short circuit" is a broad one and it usually refers to the case where an electric conductor of practically zero resistance is connected across the opposite sides of an electric circuit, causing the current in that circuit to rise to 10 or possibly 100 times its normal value, the result being that the fuse or other protective devices open the circuit. If no protective devices are provided in the circuit, the storage battery or dynamo feeding the circuit will be damaged, due to the heavy current surging through this circuit caused by the low resistance "shorting" conductor. If you have 10-ampere fuses in a house lighting circuit and you suddenly short-circuit a fuse or switch block with a screw driver, a current of possibly 50 to 100 amperes passes for the fraction of a second and the fuses melt. If this did not happen, the conductors would get hot and possibly set fire to the house. A.C. transformers and alternators can stand momentary overloads approximating a short circuit, where D.C. dynamos or storage batteries would be ruined. Cases are on record where a heavy short circuit current has caused a dynamo or storage battery to actually "blow-up" or burst.

Another way of describing a short circuit is to adapt Ohm's law to the conditions on hand. The current which flows in a circuit is equal to the electro-motive force divided by the resistance of the circuit. The smaller the resistance becomes, the greater the current will be. Theoretically when the resistance of the circuit becomes zero, the flow of current will be indefinitely large. It is quite possible in the case of a battery or generator to short circuit the terminals with a conductor whose resistance is practically zero. Under this condition, the current would rise to infinite proportions if it were not for the fact that the battery or generator has what is called an internal resistance. It is this internal resistance which keeps the value of the current down under the short circuit conditions. The short circuit current is different for different types of batteries. In the case of the Daniel or gravity battery, a short circuit for a period of a few hours is not only harmless but also necessary to the battery being "polarized." The gravity battery has a very high internal resistance and this keeps the short circuit current down to a low value. Most other types of batteries are usually exhausted and waste zinc and battery solution by short-circuiting.

If a large A.C. or D.C. generator is short-circuited, the current rises to enormous proportions and serious damage often results, due to windings burning out or being so strongly attracted to each other by virtue of their enormous magnetic field that they are actually drawn out of the armature slots and twisted out of shape.



Q. 2112. The four drawings above show the connections made by trolley car controller to vary the current supplied to the motors.

TROLLEY CAR CONTROLLER

(2112) Q. 1. B. Brown, Indianapolis, Ind., desires to have explained the action that takes place when the handle of a trolley car motor controller is set on the various notches.

A. 1. Referring to Fig. 1 we see that both the motors, which are of the series type, are connected in series with a resistance across the line, one side of which is the trolley wire, the track and ground acting as the return. This corresponds to the condition when the controller is on the first notch. Moving the controller handle to the second notch cuts out the series resistance, leaving the two motors connected in series across the line. This is shown in Fig. 2. Fig. 3 shows what happens when the handle is placed on the third notch. The two motors are now connected in parallel with the resistance in series with both motors. In the fourth or full speed position indicated in Fig. 4 the series resistance is cut out, leaving both motors connected in parallel directly across the line.

GAMMA RAYS

(2113) Q. 1. W. Brown, Toronto, Canada, would like to have explained the method by which gamma rays are generated and the uses of the gamma ray.

A. 1. Gamma rays are produced by the disintegration of radium, you will find some valuable information on this point in the very interesting book, "The Interpretation of Radium," by Soddy. A stamped self-addressed envelope will bring you the name and address of the publishers of this book.

BLUEPRINT PAPER

(2114) Q. 1. Victor D. Clark, Chicago, Ill., asks how blueprint paper is prepared.

A. 1. The ordinary blue photographic print in which white lines appear on a blue ground may be made on paper prepared as follows:

A. Potassium ferricyanide ..... 10 drachms
Distilled water ..... 4 ounces
B. Iron ammonia citrate ..... 15 drachms
Distilled water ..... 4 ounces

Mix when wanted for use, filter, and apply to the surface of the paper.

With this mixture no developer is required.

The paper after exposure is simply washed in water to remove the unaltered iron salts. The print is improved by immersion in dilute hydrochloric acid, after which it must be again well washed in water.

PREPARATION OF CONCRETE

(2115) Q. 1. Maurice Putnam, Rochester, N. Y., asks: What is concrete and how is it prepared?

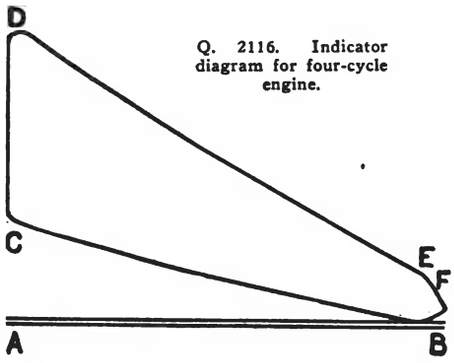
A. 1. Concrete as used by engineers in construction is generally formed of an artificial mixture of Portland cement and an "aggregate" consisting of sand and gravel or broken stone. These ingredients are mixed with water either by hand or by machine mixers. When in a semi-liquid form the material can be shoveled or poured into molds, and will gradually harden in either air or water, forming an artificial stone of high strength. The compressive strength of concrete varies with the quality and proportion of the materials; the compressive and tensile strength are both tested.

The ingredients are usually measured by volume, the actual percentage of each being determined by measuring the percentage of voids or air spaces contained in the sand and in the gravel or broken stone. The principle in mixing concrete is based upon completely filling the voids or air spaces in the sand with cement and the voids in the gravel with sand. In order to obtain as nearly as possible a perfectly homogeneous and solid mass free from air spaces, the percentage of voids in the sand is determined by filling a pail whose volume is known full of sand and pouring in water until the pail just begins to overflow. The water is then drained off and its volume measured. This gives the percentage of air spaces contained in the sand. The same process is followed in determining the percentage of voids in the gravel or broken stone. The concrete most generally used in the average type of structure is proportioned of 1 part of cement, 2 parts of sand and 4 parts of gravel or broken stone. The ratio is modified slightly for different class of work.

ACTION OF FOUR-CYCLE ENGINE

(2116) Q. 1. James Powell, Atlanta, Ga., asks: Please explain by means of an indicator diagram the action of the four-cycle gas engine.

A. 1. In the four-cycle engine, the ignition of gas takes place in one end of the cylinder every *two* revolutions of the flywheel or every two double strokes. The following sequence of operations takes place during four consecutive strokes: (a) intake of a mixture of gas and air during an entire stroke; (b) compression during the second



Q. 2116. Indicator diagram for four-cycle engine.

(return) stroke; (c) ignition at or near the dead-point and expansion during the third stroke; (d) expulsion of the burned gas during the fourth (return) stroke.

The figure shows an indicator diagram of a four-cycle engine. AB, the lower line shows the admission of the mixture, at a pressure slightly below the atmosphere on account of the resistance of the inlet valve. BC is the compression into the clearance space, ignition taking place near C and combustion with increase of pressure continuing from C to D. The gradual termination of the combustion is shown by the rounded corner at D. DE is the expansion line, EF the line of pressure drop as the exhaust valve opens, and FA the line of expulsion of the burned gases, the pressure being slightly above the atmosphere on account of the resistance of the exhaust valve.

X-RAY HAIR REMOVER

(2117) Q. 1. J. L. Phillips, Detroit, Mich., asks: Can X-rays be used for the removal of superfluous hair?

A. 1. It is possible to employ X-rays for this purpose but the operation must be performed by an expert, since, if the treatment is not properly administered, very severe X-ray burns may result. The apparatus must be so adjusted that it affects the hair roots only and not the skin.

SYMPATHETIC INKS

(2118) Q. 1. Victor H. Russell, Chicago, Ill., desires to have described the methods of preparing invisible ink.

A. 1. Invisible ink, or sympathetic ink, as it is sometimes called, may be made of lemon juice, sulphuric acid or cobalt chloride. Other substances may also be used. If the writing is done with a solution of sulphuric acid it is invisible until heated, whereupon it turns brown. The action is similar if lemon juice is used as the writing fluid. In the case of cobalt chloride, the writing is at first invisible and turns pink when heated. After a while, the cobalt chloride absorbs moisture from the air and disappears again, reappearing upon being heated.

WIRING CIRCUITS

(2119) Q. 1. Clifford Harveson, Spring Grove, Minnesota writes: I have noticed in wiring houses for electric lights that No. 12 B. & S. Gauge is used for the main wires. For the branch circuits No. 14 is used. Is this the correct way of doing it? I should think a short circuit on the No. 14 wires would cause the latter to burn out before the fuses on the main line would blow.

A. 1. In an electric wiring system, the mains are, as a rule, made heavier than the branch circuits because they have to carry the sum total of the currents flowing in all of the branch circuits. Each branch circuit must be individually fused, according to the National Electric Code. A short circuit on any of the branch circuits would cause the fuses in that circuit to blow. If, for some reason, these fuses do not blow, then the main fuses will in all probability blow before the branch wires become sufficiently heated to burn out.

TESTING OF GASOLINE

(2120) Q. 1. A. Donovan, Seneterre, Quebec, Canada desires to know what methods may be used for testing the quality of gasoline, how to detect the presence of kerosene and water in gasoline and to determine the percentage of each.

A. 1. To test for the presence of impurities in gasoline, it is only necessary to pour a few drops in a saucer and to allow it to evaporate in the open air. The residue, whether it be in solid or liquid form is the impurity. This test will also indicate the presence of kerosene, the latter remaining as a liquid in the saucer. In order to determine the proportion of kerosene, a measured amount of gasoline is evaporated at a temperature of from 80 to 100 degrees Fahrenheit, the liquid remaining behind being kerosene, and if the amount is measured it will give an idea of the proportion of kerosene to gasoline in the original sample. The presence of water in gasoline is easy to detect by pouring some of the gasoline in a test tube and allowing the tube to stand undisturbed for a few minutes. The water, being heavier than gasoline, will settle to the bottom in a separate layer, if there is any water present in the sample.

MAKING HAIR STAND UPRIGHT

(2121) Q. 1. Walter Gehring, Detroit, Mich., asks: How is it possible to make the hair rise by means of radio or electricity?

A. 1. This may be accomplished by means of a high frequency coil such as a Tesla or Oudin coil. Another method is to stand directly underneath a rapidly moving leather belt. The static electricity generated will attract the hair and make it stand upright. The second method is only practical if performed in cold dry weather.

Q. 2. Is it injurious to the hair or skin?

A. 2. The hair or skin is not injured in any way in the performing of experiments of this nature. The only thing felt is a sharp tickling sensation.

Q. 3. Where can I obtain details and complete instructions for building an apparatus for carrying out the experiment?

A. 3. A large Tesla coil was described in the March, 1925 issue of THE EXPERIMENTER. Another article of this nature appears in this issue of SCIENCE AND INVENTION Magazine.

(2122) Q. 1. George E. Stevens, Athens, Ga., asks for data regarding the earth.

A. 1. Equatorial radius, 6,378,388m., 3,963.399 mi. Polar radius, 6,365,909 m., 3,949.992 miles.

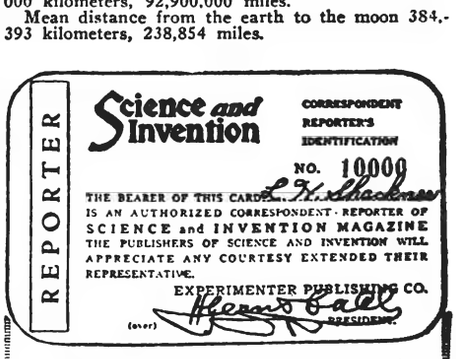
1° latitude at the equator = 68.70 miles.

1° latitude at the pole = 69.41 miles.

Mean density of the earth, 5.52 g. per cu. cm.

Mean distance from the earth to the sun 149,500,000 kilometers, 92,900,000 miles.

Mean distance from the earth to the moon 384,393 kilometers, 238,854 miles.


REPORTER
Science and Invention
CORRESPONDENT REPORTER'S IDENTIFICATION
NO. 10000
THE BEARER OF THIS CARD IS AN AUTHORIZED CORRESPONDENT-REPORTER OF SCIENCE and INVENTION MAGAZINE THE PUBLISHERS OF SCIENCE AND INVENTION WILL APPRECIATE ANY COURTESY EXTENDED THEIR REPRESENTATIVE.
EXPERIMENTER PUBLISHING CO.
(over)
PRESIDENT

IN ORDER to present to the public the very latest scientific details, SCIENCE AND INVENTION maintains a large staff of field reporters. Any one of our readers is eligible to join this staff and, upon request, a reporter's card will be forwarded, together with complete instructions for gathering material. The reporter's card is illustrated above, and its use will gain admittance to many places that would otherwise be closed to the ordinary person. You need not have any special ability to obtain one of these cards other than a desire to help others to gain knowledge.

Address, Field Editor, SCIENCE AND INVENTION.

Submitted manuscripts cannot be returned unless accompanied by postage.

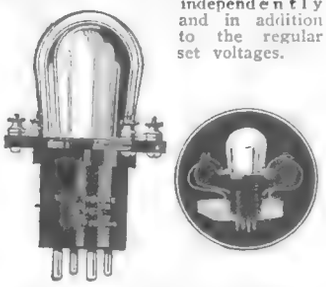
Van Horne Tubes are manufactured in both the Selected and Certified brands.

The Van Horne Certified tube is wrapped in a glassine wrapper and sealed. A characteristic curve sheet, covering the actual readings of the tube, being enclosed.

They are in a number of types for all receiving purposes, part of them being illustrated below.

*Adapted Mogul 5 VCX, 5 Volt .50 Ampere Audio Amplifier

To eliminate any necessity of changing set wiring the Mogul 5 VCX is equipped with a Patented Adapter to which additional voltages are added independently and in addition to the regular set voltages.



5 VC, 5 Volt .50 Ampere Audio Amplifier

This model is not equipped with the patented Van Horne Adapter found on the model 5 VCX.

It is designed for those receiving sets in which provision has been made in the circuit for the use of the power tube at extra voltages in the last audio stage.

5 VAX, 5 Volt, ¼ Ampere Detector Amplifier

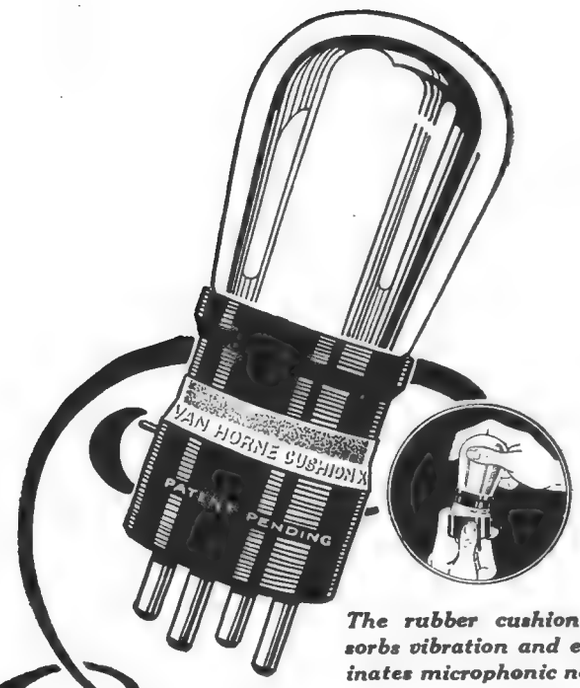
The improved manufacturing process, the use of patented thoriated wire and the precision and care with which this tube is made and tested makes it noticeably superior. Packed in both Selected and Certified Brands.

3 VBX Dry Cell Detector Amplifier

An unusually high reading dry cell tube due to the use of patented thoriated tungsten filament. Exceptionally satisfactory where volume with clearness and signal carrying capacity is desired.

NOTE

All Van Horne Tubes are Unconditionally Guaranteed.



The rubber cushion absorbs vibration and eliminates microphonic noises

Cushioned

to stop vibration— that's why the Cushion Base Tube makes such a wonderful improvement in reception

Knowing how much tube vibration impairs the tone quality of reception, fans everywhere are equipping their sets with Cushion Base tubes.*

Equip your set with Cushion Base tubes and note the surprising softness and fullness of tone of reception that follows the elimination of vibration. Order your set from your dealer today.

*These two unusual tubes, the Adapted Mogul 5 VCX Power tube and the Cushion Base tube, offer the greatest possible improvement in reception. They are manufactured exclusively by the Van Horne Company under patents pending to J. S. Van Horne.

For a great many years the Van Horne Company has manufactured vacuum products. The highly skilled workmanship that goes into every Van Horne tube is the result of years of experience and is one of the factors that make Van Horne tubes the highly efficient and dependable tubes that many thousands of users have found them to be. You are urged to become acquainted with the complete line of Van Horne Selected and Certified tubes. Your dealer will supply you with further information—or write for descriptive matter.

THE VAN HORNE COMPANY, Inc.

903 CENTER STREET, FRANKLIN, OHIO

HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School
Dept. H-675
Drexel Ave. and 58th St., Chicago

American School
Dept. H-675 Drexel Ave. & 58th St., Chicago
Send me full information on the subject checked and how you will help me win success.

Architect	Lawyer
Building Contractor	Machine Shop Practice
Automobile Engineer	Photoplay Writer
Automobile Repairman	Mechanical Engineer
Civil Engineer	Shop Superintendent
Structural Engineer	Employment Manager
Business Manager	Steam Engineer
Cert. Public Accountant	Foremanship
Accountant and Auditor	Sanitary Engineer
Bookkeeper	Surveyor (& Mapping)
Draftsman and Designer	Telephone Engineer
Electrical Engineer	Telegraph Engineer
Electric Light & Power	High School Graduate
General Education	Fire Insurance Expert
Vocational Guidance	Wireless Radio
Business Law	Undecided

Name .....
Address .....

Answers to Scientific Problems

(*Continued from page* 420)

THE HYDROMETER IN THE PAIL

AS the pail is whirled around in a vertical circle the pressure within the water is increased when the pail is at the bottom of its orbit on account of the centrifugal force which is then added to the natural weight of the water. At the top of its orbit the internal pressure becomes zero because the weight of the water is just balanced by the centrifugal force of the rotating liquid. With an increased internal pressure at the bottom of the orbit the buoyancy of the liquid will increase and make the hydrometer float higher whereas at the top of its path the decreased internal pressure will allow the hydrometer to sink indefinitely into the liquid.

THE BALLOON PROBLEM

A balloon will rise provided its own weight, including that of its contents, is less than the weight of the air which it displaces. If the speed of the earth's rotation should increase, the centrifugal action would decrease the weight of the atmosphere and hence the buoyant force on the balloon. Thus the lifting power would be decreased everywhere except, of course, at the poles. If the earth should rotate about seventeen times as fast as at present, the weight of the atmosphere would become zero and hence the buoyant force would also be zero. It would then be an easy matter to project even very massive objects from the earth, but the buoyancy of the atmosphere would not cause any object to rise.

THE SWINGS

If one of the boys should set his swing in motion he would by that action produce a centrifugal force on his swing which would gradually raise his comrade up. The motion would be somewhat jerky because the maximum pull would be exerted when the swing was passing the lowest point in its arc, that is when it was moving the fastest.

THE SLIPPING LADDER

Consider the ladder as a lever system with its pivot at point A on the ground. As the man ascends the ladder the moment due to his weight (W x AB) increases and this increases the tendency for the ladder to turn about the pivot A. This means the nearer the man is to the top of the ladder the harder the ladder will push against the wall and the greater will be its thrust horizontally against the ground.

VELOCITY OF LIGHT AND THE LENGTH OF THE DAY

Since it takes a little over eight minutes for the light from the sun to reach the earth, we can see that the light which we see at any moment must have started from the sun some eight minutes ago. The apparent direction in which the sun lies is the direction which it had about eight minutes ago. At sunrise we see the sun eight minutes after it was actually on our horizon, while at sunset we see it for eight minutes after it has actually set. Thus the day begins eight minutes later and ends eight minutes later than it would if light had an infinite velocity.

THE BATTERY AND THE VOLTMETER

The voltage across a storage battery while on charge is exactly the E.M.F. of the battery plus the fall of potential due to internal resistance. This fall of potential is equal to

(*Continued on page* 448)

CHICAGO TECHNICAL COLLEGE

Drafting Engineering Electricity and Architecture

23rd Year

A MAXIMUM of practical training in a minimum of time is offered you by one of **"America's oldest and largest schools of specialized engineering"** . . . technical training of college standard for men who have neither the time, money nor preliminary education to attend a university. Over 1000 men enroll each year in day and evening classes.

Short, Intensive Training of a very practical sort puts you immediately into a high salaried position. Many of our students are assisted to responsible positions before graduation . . . they earn while they learn.

Chicago Technical College Bldg.

If you can't come to Chicago **STUDY AT HOME**
Ten months from today you can be a trained craftsman...Trained men are in demand...at high salaries. Enter a profession, without sacrificing time. Study

DRAFTING
in your spare time...We have been giving technical training for 23 years...Instructors are experts, the same instructors as in the resident school.

FREE TRIAL LESSON
To see how much you will like this high-grade profession, and

FREE OUTFIT
a regular $25 draftsman's outfit is included in the price of the course.

Send for 40-Page Book
of facts about drafting... send for it...free. Write today for the Free trial lesson in drafting, sample drawings made by students and the book of information. Address Dept 945.

Courses are arranged to suit your needs: 2-year diploma; 3-year B. S. degree; special short courses adapted to the individual. Instructors are experts, actively at work in the very professions they teach. Tuition is low, terms easy. Enter any time.

Write for Free 72-Page Blue Book
It tells about the courses (full descriptions); about the great demand for Chicago Technical College trained men; about college athletics and other interesting facts you'll want to know. Send for the Blue Book now, without obligation! Address

Chicago TECHNICAL College
Dept. 59, 118 East 26th St., Chicago

New Scientific Discovery Starts GASOLINE REVOLUTION
FREE Sample to Agents

THERMO-VAC STOPS GAS WASTE
Entirely new and Proven Principle of Automotive Engineering, finally perfected by inventor of original Stephens Motor Car, now assures Ford owners of increased mileage and tremendous new power, never before thought possible.

Wonderful Opportunity AGENTS
Exclusive Territory for
Tremendous selling campaign about to be launched. No competition. Powerful clinching demonstration. Rapid fire seller. Easy to make $200.00 weekly if you get in Now. Write immediately for exclusive territory and liberal profit arrangement.

FREE To introduce Thermo-Vac, we are giving away absolutely free, the famous Automatic gasoline gauge and reserve known as GASIGNAL. Get details without delay.

MACK LABORATORIES
720 Cass St., Dept. 863M. Chicago, Ill.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. **THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES.** Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several small articles, **Price 25c. Larger sizes 50c and $1 postpaid. Johnson Smith & Co., Dept. 347 Racine, Wis.**

The "Little Giant" Typewriter

A First Class Writing Machine For $1.50

A perfect little typewriter for $1.50. There are the thousands of persons who would like to use a typewriter but whose needs and business do not warrant the expense attached to the purchase and use of a fifty or seventy-five dollar machine. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that anyone can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used are so grouped as to enable one to write rapidly, the numerals 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewritten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large, expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. **Price complete $1.50 by mail postpaid to any address in the world.**

Every Boy His Own Toy Maker

Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled Bird House, Rabbit Yard, etc. 64 pages, 150 illustrations. **PRICE, 10c postpaid; 3 for 25c.**

GOLD TEETH

You know how fashionable it is to have gold crowns, if you can afford it. These gold-finished shells fasten over your real teeth and look like very wealthy fillings. Can be slipped on and off in an instant. Get some and surprise your friends. **6 Cents Each, 3 for 15c, or 50c for 1 doz., postpaid.**

JOHNSON SMITH & CO., Dept. 347 Racine, Wis.

REAL PISTOL — Miniature Watch Charm Pistol

Exact reproduction of a real pistol; actually fires Real BLANK CARTRIDGES of miniature size. Illustration is actual size. 1¼ inches long, with ring at end for attaching to watch chain. Loads like a regular pistol. Pull the trigger and it goes off with a loud bang. Pistol is break-open type; illustration shows position for loading. Made entirely of high grade steel, nickel plated, octagon barrel, handsomely engraved handles, complete in box with cleaning rod. **PRICE $1.75.** Also furnished with **pearl handles, $2.50.** BLANK CARTRIDGES, 50c per box of 25.

BOYS! BOYS! BOYS!

THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

THE VENTRILO

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it.

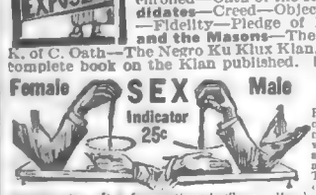
Never Fails. A 32-page book on ventriloquism, and the Ventrilo, ALL FOR 10c postpaid.

MIDGET BIBLE
GREAT CURIOSITY

Smallest Bible in the world. Size of a postage stamp. **200 Pages.** Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE **15c** each, **3** for **40c**, **12** for **$1.25**, **100** for **$7.50.** Also obtainable in Leather Binding, with gold edges. **Price 50c each, 3 for $1.25, $4.50 per doz. Magnifying Glass** for use with Midget Bible. **15c**

K.K.K.

Everything about the **Ku Klux Klan** told in a clear, fearless manner. Book tells all: How it started and was suppressed in 1871—The New Ku Klux Klan—How organized—How members are enrolled—Oath of the Klan—**Questions for Candidates**—Creed—Objects of the Order—Obedience—Fidelity—Pledge of Loyalty—**Ku Klux Klan and the Masons**—The Jews—The Masons—Real K. of C. Oath—The Negro Ku Klux Klan, etc., etc. Latest and most complete book on the Klan published. **Price, 35c,** postpaid.



SEX INDICATOR

Hold the **MAGIC INDICATOR** over a man's hand—instantly it moves in a straight line, backward and forward. Hold it over a woman's hand and it describes a complete and continuous circle. The same action can be obtained over a letter written by a man or woman, etc. It is fascinating; baffling. We have never been able to figure out how it's done—but we've never seen it fail. Many novel and entertaining feats may be performed with the Sex Indicator. For example, similar results can be obtained with animals, cats, dogs, rabbits, even birds, chickens, canaries, etc. Also used to predetermine the sex of chickens and birds, etc., in fact it is sold as a patented egg tester in Europe. **Price 25c, or 3 for 65c, postpaid.**

STAGE MONEY

With abundance of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. **Prices, postpaid: 40 Bills 20c, 120 for 50c, or $3.50 thousand postpaid.**

Wonderful X-Ray Tube

A wonderfullittle instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. **Price 10c, 3 for 25c. 1 dozen 75c. Johnson Smith & Co.**

Good Luck Ring

Quaint and Novel Design

A VERY striking and uncommon ring. Silver finish, skull and crossbone design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, **Good Luck Ring.** Very unique ring that you will take a pride in wearing. **ONLY 25 CENTS.**

Exploding Cigarettes

JUST LIKE ORDINARY CIGARETTES, BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud **BANG!** A great mirth provoker yet entirely harmless. **Price 25c per box.**

Popular Watch Charms

15c

ONLY 3 for 40c; $1.35 doz.

Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

CIGARETTE MAKER

Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs ½ oz. Made entirely of metal, nickel-plated. **Price 25c postpaid.**

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

Post Paid **25c**

The Magic Flute, or Humanatone, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produces very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument, the effect is as charming as it is surprising.

Novelty Badges

Kissing Permit 10c *Garter Inspector 10c*

Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. **10c, each badge, 3 for 25c, or 75c per doz. p.p.d.**

BLANK CARTRIDGE PISTOL

Price $1.00 Postpaid

This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard .22 Calibre Blank Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. **A Great Protection Against Burglars, Tramps and Dogs.** You can have it lying about without the danger attached to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. **PRICE ONLY $1.00 Postpaid. Blank Cartridges 22-calibre shipped by express only, 50c per 100. Johnson Smith & Co., Dept. 347 Racine, Wis.**

Sneezing Powder

Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For **parties, political meetings, car rides,** or any place at all where there is a gathering of people, it is the **greatest joke out. Price 10c or 3 for 25c**

Mystic Skeleton

10c postpd.

A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner. **Price per box 10c ppd.**

Microphone Transmitter Button

$1.00 POST-PAID

You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in micro-phones. You can mount the button almost anywhere—card board boxes, stove pipes, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. $5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE $1.00 POSTPAID ANYWHERE.**

ANARCHIST BOMBS

One of these glass vials dropped in a room full of people will cause more consternation than a limburger cheese. The smell entirely disappears in a short time. **10c a Box, 3 Boxes for 25c**

INVISIBLE INK

The most confidential messages can be written with this ink, for the writing **MAKES NO MARK.** Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. **Only 15c Bottle**

ITCHING POWDER

This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. **10c box, 3 boxes for 25c or 75c per doz boxes postpaid.**

LOOK 35¢ Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngascope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. **Price, only 35c or 3 for $1.00** postpaid.

RESURRECTION PLANT

One of the most wonderful plants known. Possesses the strange power of turning in a few minutes from an apparently lifeless, dry herb to a BEAUTIFUL LIVING FERN-LIKE PLANT of a dark green color. Simply place the plant in saucer of water, it will open up and start to grow in 20 minutes. When taken out it will dry up and go to sleep until placed in water again. Fine house plant—summer or winter. **10 cents each or 3 for 25c,** postpaid. **Agents Wanted**

A DeLuxe Edition of our new 1926 CATALOG mailed on receipt of 25c. Handsome cloth binding. Only book of its kind. 480 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, interesting books, curiosities in seeds and plants, etc., procurable elsewhere.

ADDRESS ORDERS FOR ALL GOODS ON THIS PAGE TO

JOHNSON SMITH & CO. DEPT. 347, RACINE, WIS.

Postage Stamps Accepted

Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing*. That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business methods and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 10,000 *Graduates are Successful Men in the Electrical World*

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

The N. Y. E. S. gives a special course in Automotive Electricity. The course covers completely all systems of Ignition, Starters, Lighting, Storage Batteries and other electrical equipment on automobiles, motor-boats and aeroplanes, etc.

Let us explain our complete course to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 West 17th Street, New York

New York Electrical School
29 W. 17th St.,
New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... Name

..... Street

..... City

Why Wear Glasses? *Thousands Are Throwing Them Away*

Upon startling revolutionary facts has been based a remarkable new scientific system of eye-training, which quickly enables you to train the muscles of the eye so you can make them work properly at all times, and without effort or strain. This new system has been prepared by Bernarr Macfadden, in collaboration with the eminent ophthalmologist who discovered the real truth about eyes.

Remarkable tests were made in the N. Y. City Public Schools from 1903 to 1911. 2,000 children who had defective eyesight were instructed in a few of the simple exercises and in a short time their vision was radically improved. In one school, several children who had been compelled to wear glasses were enabled to discard them altogether.

No claim is made that this course is a cure-all. In many cases glasses are essential. But if you are wearing glasses because of faulty refraction —far or near sightedness—astigmatism—cross eyes —squint eyes—weak, watering eyes—eye headaches or strain—you owe it to yourself to try this course without delay.

Cross section drawings show plainly the whole mechanism of the eye—muscles and nerves. Photographs of defective eyes make clear the real reasons for poor sight. Your own trouble is clearly illustrated. With this knowledge in mind, it becomes easy for you to correct your defective muscles and gain strong sight.

We are willing to send the entire course on approval giving you the privilege of returning it within five days after receipt if not satisfactory. The price of the course is only $3.00, plus delivery charges.

MACFADDEN PUBLICATIONS, Inc., Dept. Sc-9, 1926 Broadway, New York City

Answers to Scientific Problems

(*Continued from page* 446)

the product of the charging current and internal resistance. If for example, a battery had an E.M.F. of 6 volts and no internal resistance a voltmeter connected to its terminals would read just 6 volts no matter what current were used to charge the battery. In a good storage battery the resistance is not zero but is so slight that the product of the charging current times this resistance is negligible in comparison with the E.M.F. of the battery itself. Hence the reading of a voltmeter connected to such a battery on charge remains practically equal to the voltage of the battery regardless of the voltage of the charging circuit. Certainly it would be a pretty poor six-volt battery if its resistance were so great that a 0 — 7-volt voltmeter could not be used with it.

CHANGE OF WEIGHT

As a person descends a mine his weight is reduced by the attraction for his body of that portion of the earth which lies above him. If he continued down to the center of the earth his weight would, of course, become zero since the gravitative pull of the earth would be equal in all directions.

THE POLE-SWING PROBLEM

The child that is farthest from the ground will not only move with greater speed in the circular orbit which he describes around the pole, but he will also make a complete trip around the pole in shorter time. This comes from the fact that it takes a higher circular velocity to give the child sufficient centrifugal force to carry him farther out and higher up in his orbit. If the children were at the same distance above the ground they would be moving around the pole in the same time although the child on the longer rope would be moving more rapidly with respect to the ground.

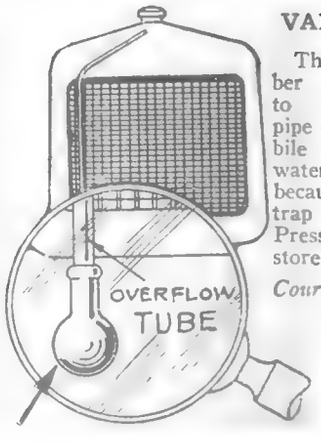
CORRECTION NOTICE

In the "Experimental Electrics" Department in the July issue in the "Puzzle Lamp Circuit," by W. B. Taylor, four four-way switches should be employed, instead of four three-way switches.

RUN CARS WITH ACETYLENE

The Automobile Club of France announced recently that the tests for the substitution of acetylene for gasoline in automobile motors have given complete satisfaction.

An enthusiastic report states that the economy amounts to about 50 per cent., with no increase in the consumption of lubricants and no bad effects on the valves, cylinders or pistons.



VAPOR TRAP

The small rubber bulb attached to the overflow pipe of an automobile radiator saves water and alcohol because it forms a trap for the vapor. Pressure does not store up.

Courtesy Jo Berge Company

"BUILD YOUR OWN" WITH "RASCO" PARTS!

Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page

NEW GOODS FOR SEPTEMBER

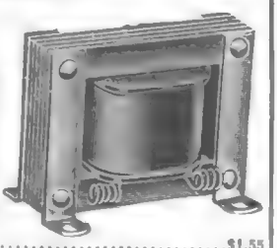
Money refunded if goods do not satisfy

RASCO "B" BATTERY ELIMINATOR SUPPLIES

SEND FOR FREE BOOKLET: "HOW TO BUILD AN EFFICIENT "B" ELIMINATOR"

CHOKE

$1.55 POSTPAID



This excellent choke, especially manufactured for "B" battery eliminators, has used in the standard eliminators, has about 40-millihenry capacity, (10,000 turns of No. 32 wire) and is warranted to do the work right. Will not heat or burn out under normal load.

No. S4002, Choke $1.55

HIGH CAPACITY CONDENSERS

$0.60 POSTPAID

These are standard condensers and are of the best vacuum impregnated paraffin type. The insulation is specially-prepared paper, and the units are compressed hydraulically before they are sealed in their metal casings.

All of our condensers are tested for 500 volts breakdown; each condenser comes in an enameled black tin casing.

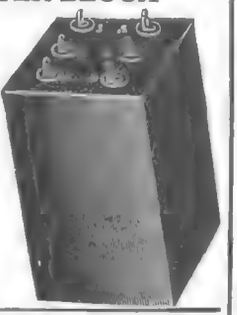
There are two metal terminals to which wires or bus bar can be readily soldered. We have developed these condensers especially for "B" eliminator work, and we believe our prices are the lowest in the country.

Try connecting a number of these condensers together. You can make any capacity. "Filter Block" for any style "B" or "A" eliminator.

No. S4007, 4-Mf. Condenser, each $2.00
No. S4008, 3-Mf. Condenser, each 1.65
No. S4009, 2-Mf. Condenser, each 1.30
No. S4010, 1-Mf. Condenser, each 0.75
No. S4011, ½-Mf. Condenser, each..... 0.60
No. S4012, ¼-Mf. Condenser, each..... 0.50

RASCO FILTER BLOCK

$3.65 POSTPAID



This is the high capacity 500-volt tested condenser system used in the standard "B" Battery Eliminators. Contains 4 condensers, all in one housing, as follows, 4 mfd., 2-mfd., ½-mfd., ½-mfd., total 7½-mfds. Complete as illustrated, with 5 terminals; in enameled tin shell.

No. S4001 Block $3.65

RESISTANCES

$0.50 POSTPAID

These resistances are standard for eliminators and will carry about half a Watt on continuous load. Glass enclosed, cartridge type. Two of these must be used in standard eliminators. The resistance is 10,000 Ohms per unit. Resistances come complete with two spring clip mountings.

No. S4005, "B" Eliminator Resistance, 10,000 Ohms Each, $0.50

ELECTRODES

For those who wish to make their own rectifiers, we supply electrodes. The success or failure of a rectifier lies in the purity of the aluminum used. We use only 99.5 per cent pure Aluminum in connection with our rectifiers.

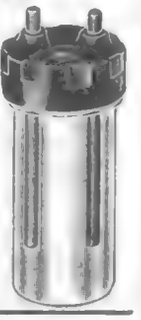
The small electrodes measure 3¼" long by ¼" diameter. The large electrodes are 5" long by ½" diameter, and are equipped with one threaded end and square composition nuts. The large electrodes are intended for pint jars.

No. S4015, Small Aluminum Electrode $0.10
No. S4016, Small Lead Electrode 0.08
No. S4017, Large Aluminum Electrode 0.35
No. S4018, Large Lead Electrode 0.30

PRICES POSTPAID

RECTIFIER CELLS

$0.60 POSTPAID



These rectifier cells, of which four must be used for the complete full-wave rectification, are standard with us, having been specially designed for "B" eliminator work. These 4-oz. jars, with acid- and heat-proof rubber screw covers, are furnished with two electrodes, namely pure aluminum and lead. A vent cap is also provided. The special connectors listed below should be used for connecting the cells together. Size 4⅞"x2¼".

No. S4003, Rectifier Cell (but no connectors nor salts) complete with cover and electrodes ..... each $0.60

CONNECTORS

$0.25 POSTPAID

These special connectors are used in order to connect four of the rectifier cells together. Set of 4 special connectors sold as one unit. These connectors snap over the round electrodes, giving it positive binding contact at all times, that stays put. No loose connection possible. Illustration shows how connector clamps over ¼" rod. Center Hole is used for screw and nut binding post. Made for ¼" rod only.

No. S4004, Set of 4 electrode connectors $0.25

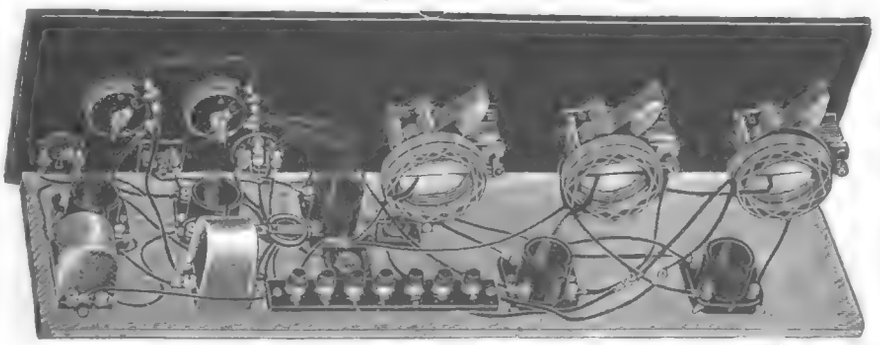
RECTIFIER SALTS

$0.20 POSTPAID

Only long experience can produce the correct "B" eliminator rectifier salts. Borax and similar salts "creep" over the electrodes and usually short circuit them. Our patent salt combination is guaranteed to keep electrodes clean and will not "creep." Sold only in units for our No. 4003 rectifier cell. One filling charges one cell.

No. S4006, Rectifier Salts, per box (one complete charge) ..... each $0.20

RASCO 5-TUBE TUNED RADIO FREQUENCY RECEIVER $17.95



S9216A

Build Your Own Receiver—

It's Easy The *"No-Sod-er* Way

Revolutionary Improvement in Assembling Radio Sets

No solder—No bare wires—No poor connections—No dissatisfaction.
No tools needed except a common screw-driver and common pliers.
All connections are made by the use of our flexible, insulated eyeletted connecting wire in place of bus bar or wire, and solder.
And in a fraction of the time usually required when building the old fashioned way. And when the job is done it is neat and your connections are tight.

We Furnish a Special Blueprint Free With Each Kit
Connections Always Perfect

PARTS INCLUDED IN THIS RECEIVER

Cabinet, mahogany finish, 7x26x8 .....$5.34
Panel, drilled and engraved, Bakelite-Dilecto, 7x26 ..... 3.50
Baseboard, laminated ..... .40
Coils, tuned transformers, our No. 2629..... 1.05
3 Variable condensers, .00038 Capacigrad @ $1.70 ..... 5.10
3 4-Inch Pilot Dials ..... .75
2 Transformers, audio frequency, Pacent @ $3.75 ..... 7.50
2 Rheostats, 20-ohm, Pilot ..... .92
Sockets, low loss, Bakelite, Pilot, @ 25c 1.25
Jack, single circuit improved ..... .60
Jack, double circuit improved ..... .70
Switch, A battery, Pacent ..... .38
Fixed grid condenser and mounting, Micamoid .00025 ..... .35
Grid leak, 2 megohm, Pacent ..... .32
Fixed condenser, .002 mfd Micamoid ..... .31
Fixed condenser, .005 Micamoid ..... .44
Binding post strip, Rasco (with binding posts) .35
No-Sod-er connecting wires, full set 1.75
Necessary hardware, screws, angles, etc..... .25
Blueprint and instruction sheet 1.00

Total Price of Set.....$32.24
Our price, Catalog No. S9216.....$22.95
No. S9210A, same kit, but without cabinet..$17.95

BIGGEST VALUE IN AMERICA

If you wish the finest 5-tube set to be had, you have it in this model. No better set made in popular-priced receivers.

Low cost compared with results obtained.

This is not a small set thrown together with questionable parts that no one knows and made only to sell. All our parts are listed by name and are standard merchandise—nothing else.

This is a BIG SET, measuring 7 x 26 inches, and there is no one in the country today who can compete with us in this particular outfit.

Note particularly that the condensers which we use are brass plate condensers of the new straightline frequency type, not obsolete straight wave-length type, which are so hard to tune on the lower waves.

NEW ADJUSTABLE COILS (Patents Pending)

In this set we use adjustable coils, which can be moved up and down, away from the condenser, until the right balance is found. This makes for an unheard of and really incredible degree of sensitivity which has not been realized heretofore in sets of this kind.

Note also that the panel comes to you all drilled, with all holes drilled in position, and that any child can put together this wonderful receiver in less than an hour.

This set is highly efficient for bringing in the greatly-desired long range reception. 3,000 miles has been covered repeatedly. This has been accomplished by using two stages of tuned radio frequency with detector and two stages of audio frequency.

The tuning is done by three large dials; the first dial controls the antenna tuning, the center dial the first radio transformer, and the last dial the second radio transformer.

Make Big Money by assembling and selling them complete to friends and business houses who need a First Class Radio. Many of our customers sell these completed sets from $30.00 upwards.

New 1926 "Rasco" Catalog No. 16

CONTAINS 75 VACUUM TUBE HOOK-UPS, 446 ILLUSTRATIONS, 500 ARTICLES

Also Logbook of all Broadcast Stations

Just to name a few of the circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; all Reflex Circuits.

FREE

A POSTAL CARD BRINGS IT

RADIO SPECIALTY COMPANY, 100 Park Place, New York City

Factories: Brooklyn, N. Y. Eldridge, Md.

Men relate

this simple way to get

a new thrill in shaving

Men the nation over are awakening to the fact that there is a general switch to the Valet AutoStrop Razor.

Its sales have pyramided in an astounding manner.

All because men are discovering that a sharp blade *for every shave* is a genuine luxury.

The Valet AutoStrop is the *only* razor that sharpens its own blades. A few strokes on its strop restore a blade to new-like keenness.

Sharpen it, then shave, then clean—all in a jiffy, and without removing the blade from the holder.

This is a different principle. The blade doesn't get duller and duller until it must be thrown away.

Every shave can be with a blade of super-keenness.

Have you fallen into a habit? Do you continue your old way of shaving?

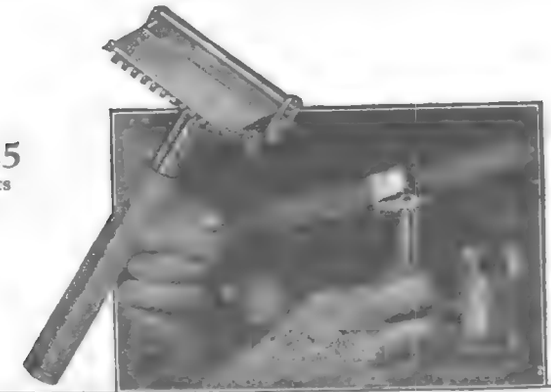
Then join the thousands upon thousands who have turned to a new and better way and whose enthusiasm never wanes.

A speedy, comfortable shave every time—uniformly perfect. An end to "pulling." An end to wasting time.

"There's no shave like it," men say. Why miss this supreme improvement?

Valet AutoStrop Razor

REG. U. S. PAT. OFF.



$5 to $25
Other sets at $1

The RAZOR That Sharpens Itself

AUTOSTROP SAFETY RAZOR CO., 656 First Avenue, New York City

Microscopic Engraving

By R. P. TOLMAN

(*Continued from page* 404)

be easily engraved in one square inch; there are 3,566,480 letters in the Bible. If you will solve this problem in division, you will find that the entire Bible could be engraved more than 49 times in one square inch. Fig. 4 represents a square inch divided into 49 equal parts, and the entire Bible could be engraved in any one of them. Engravings smaller than this have been made.

HOW MICRO-PHOTOGRAPHS ARE MADE

This kind of work is done, not by hand, but with the aid of a micro-pantograph. The first machine of this character was invented and used by W. Peters, a London banker, in 1852. The machine to make the micro-engravings shown was constructed after the Peters machine, with improvements by Mr. McEwen and by Rev. J. G. Crawford of Saunderstown, R. I.

Whatever is to be engraved is written with the pencil (a) the movement, in its greatly reduced form, is carried to the top of the machine, to the diamond point (b), but before the operator starts to write, he holds down the key (c) which is connected with a lever at the top, this brings the cover glass (d), on which the engraving is to be made, in contact with the diamond point, so that every movement of the pencil is cut in the glass, at whatever scale the machine may be set. Between each word, the crossing of a "t" or the dotting of an "i", or for punctuation marks, the pressure on the key is released, but when engraving is wanted the key in pressed.

Now just what is this diamond point and how is it prepared?

The usual reply has been, "it's a secret," but as a matter of fact, nature in fashioning the diamond has taken care of the entire work and at intervals along the planes of cleavage, ultimate crystals, as Rogers called them or, exquisite gravers for these fine lines may be found, and when carefully handled, they may be used for years. Their exact location and adjustment for this miniature engraving, however, is somewhat of a secret and for some time to come must remain an irksome series of patient trials, for I know of no royal road to finding and adjusting a crystal suitable for work of this character.

The letter first described in lead pencil was made 4 by 7 inches in size. The lead pencil letter contains 28 square inches, this was reduced to 1/11,250 of a square inch and then the reduction was enlarged by photography to about seven square inches, and yet they are alike as can be.

When you consider what this micro-pantograph will do, you marvel more and more that any human being could make a machine, which apparently has no lost motion, that can duplicate the movement of a pencil on so small a scale that the eye cannot see it and yet when enlarged it is identical. The machine itself is as wonderful as the work it does.

Fifty to sixty years ago micro-engravings were quite common, but at the present time they are very rare. The early workers were W. Peters, William Webb and R. J. Farrants. Mr. Alfred McEwen of New York City is the only worker today.

About the only use devised for these small engravings would be the sending of secret messages in time of war. They could be engraved on a stick pin, a collar button, eyeglasses or many other things and it would be impossible for anybody to detect them except the person who knew where and how to look for the messages.

(Printed by permission of the Secretary of the Smithsonian Institution.)

You can gain powerful muscles and vigorous health with this new

IMPROVED EXERCISER

THE AMERICAN SANDOW

POWERFUL muscles put new joy into living—the feeling of strength, reserve power, makes you a better man and smooths the path to success in business or at home.

The American Sandow, who's picture appears on the page has astounded thousands with his almost superhuman strength and powerful muscular development. He is acknowledged one of America's strongest men.

In order that others may enjoy this wonderful vigor and power he has developed an improved exercisor—A simple but remarkable apparatus adjustable to suit the user.

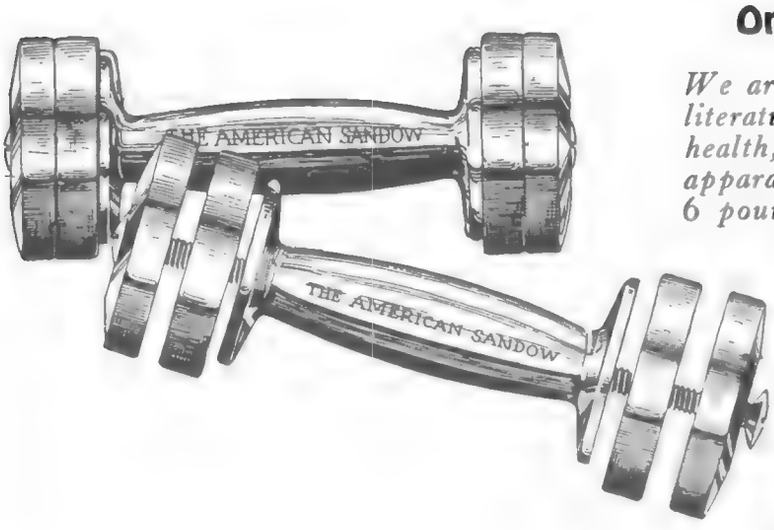
It has been acclaimed everywhere, a tremendous success—It will build muscles for you.

Price $5.00 complete

(Including Instructions)

Order Today Direct

We are not selling Booklets or literature — we are selling a health, strength and reducing apparatus. Adjustable from 2 to 6 pounds.. Send for it today. Money back if not satisfied.



CLIP HERE

AMERICAN SANDOW, Inc.
291 Broadway,
New York, N. Y.

Gentlemen—I am enclosing $5. Kindly send me at once your improved exerciser.

NAME .....

ADDRESS .....

CITY, STATE .....

THE AMERICAN SANDOW, Inc.

291 BROADWAY, NEW YORK, N. Y.

U.S. PATENTS

SEND FOR THIS FORM

Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

Registered Patent Attorneys in U.S. and Canada
255 Ouray Bldg., Washington, D. C.
"Originators of form Evidence of Conception"

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
184 Owen Building, Washington, D. C.
41V Park Row, New York City

TRADE-MARKS
REGISTERED

This Patent
FOR SALE

Valuable basic patents on sanitary improved container for tooth brushes, tubes, etc., protects from dust—novel original and practical household accessory. Several advanced features. For particulars address

ALPHONSO VUOLA
91 Webster St. - Malden, Mass.

Patent Advice

Edited By
Joseph H. Kraus

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

RESILIENT WHEEL

(956) Q. 1. J. Floyd Miller, Cincinnati, Ohio, has obtained a patent upon a type of resilient wheel and asks our opinion as to its marketability.

A. 1. There have been many resilent wheels for automobiles and other vehicles patented and brought to our attention within the past year. Most of them are not practical. The buying public does not seem to take to a device of this nature because most of the resilient wheels so far offered are clumsy and weird in appearance as well as inefficient in operation. We do not believe that there is much of a field for a wheel of this nature until something is produced that will stand up under hard usage and that will present an appearance equal to or better than that of the present day wooden spoke or metal disk wheel.

PATENT APPLIED FOR

(957) Jerry G. Cormicek, Corapolis, Penna., says that he has applied for a patent and wants to know in what way he is protected. He also wants to know how long it will take to get his patent issued.

A. The mere fact that you have applied for a patent does not allow you any protection in the eyes of the law and the patent application is of no value, except in so far as it may be a means of establishing a claim of priority, which of course, necessitates court litigation. The length of time for the issuance of a patent depends on the particular department to which the action is assigned. Most of the departments have quite a few ideas on hand which demand prior action. The nature of the claims also affect the time of issuance.

R. R. CROSSING GATE

(958) Lloyd T. Deibert, Lehighton, Penna., writes that he has been working on a railroad crossing gate for a long time and asks us how he can dispose of his idea.

A. It seems almost impossible to induce railroads to install automatic crossing gates. Furthermore, these devices are usually inoperative under certain weather conditions and therefore not infallible. The only way in which you can proceed with your device is to take up the subject with various railroad companies and explain the advantage of your device. There is a possiblity that they might be willing to view a working model and comment thereupon. Further than that, there is nothing that you can do with a device of this nature. Of course, you can apply for a patent and undoubtedly obtain one, but such a procedure would be costly and undoubtedly the patent would be of no value after it was issued.

RADIO ANTENNA PLUG

(959) Gilbert Doty, Detroit, Michigan has designed an antenna plug which is to enable the use of house wiring as an antenna for a radio set.

A. The system you described in your letter of recent date has been published in various past issues of different radio periodicals. Owing to this fact, it will be quite impossible for you to patent your system and we would not advise you to proceed further with it.

ELECTRICAL TIRE GAUGE

(960) Hal. Frederichsen, Los Angeles, California has designed an electrical air pressure tire gauge to be placed on the dashboard of a car and requests our opinion of same.

A. There are many reasons why we do not believe that your proposed type of electrical pressure gauge for tires would be at all advisable for general use. In the first place, it would undoubtedly be extremely complicated in construction and would be subject to many troubles that would naturally follow. Without any further description of the device we would certainly not advise you to proceed with attempting to patent it as we do not believe such a patent would be worthwhile. If, however, you wish us to comment specifically upon it, it will be necessary for you to submit details showing how the device operates. Unless it is something radically new and entirely different from any other devices which have been designed to accomplish the same purpose, we would not advise you to even bother to submit details.

COMBINATION RULER AND BLOTTER

(961) J. J. Bermida, Jersey City, N. J., asks us whether we think a combination ruler and blotter would be a good idea.

A. We noted the plans and specifications for your proposed combination blotter and ruler and would advise that the idea is essentially very old. In a contest which was conducted by this magazine many months ago, several designs of a similar nature were entered. This contest was for collecting together designs for combinations of various useful appliance and the idea occurred to many that a blotter and ruler combined would be useful. In view of the fact that so many prior claims to a combination of this type exist, we do not believe that it would be practical for you to proceed with your particular type and would not advise you to proceed towards attempting to obtain a patent upon it.

ELECTROLYTIC AUTO

(962) G. A. Edelman, Manhattan Beach, N. Y. asks if a system for operating an automobile consisting of electrolyzing water, mixing the gases, exploding them in a combustion engine and using the force to drive a generator and the auto, would be of value.

A. We would advise that your system is not practicable and cannot be made to operate with any degree of economy. An attempt was made some twelve years ago by an inventor in Ohio to construct an automobile identical with the principle illustrated in your drawing and specifications. His automobile was to run by the explosion of oxygen and hydrogen gas; the water formed by the explosion was to be returned to the storage tank and the running motor was to furnish the power for not only running the automobile, but also charging up the storage batteries, which latter supplied the current for the electrolyses of water. The amount of energy required to decompose water is so great that it will be necessary to install a whole group of storage batteries in the car and charge them up every day before an attempt is made to run the car for that day. The system will not replenish itself. It cannot be made to develop perpetual motion, which is what the device would do were it to operate as described.

This inventor of the water automobile sold stock in his company and then absconded with nearly all the money entered into the firm. His associates were still working upon the idea when we last heard from them.

We would advise that you forget the system entirely as it is apparently impractical.

INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for INSPECTION and INSTRUCTIONS FREE. TERMS REASONABLE. BEST REFERENCES.

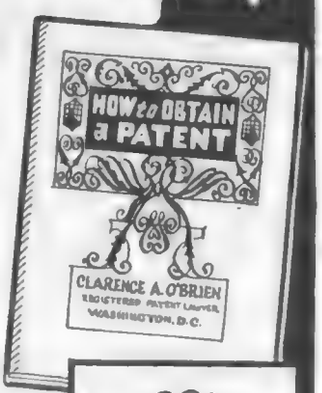
Name .....
Street .....
City .....

RANDOLPH & CO.
Dept. 172, WASHINGTON, D. C.

PATENTS

INVENTORS Write for these FREE BOOKS!

At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.



PROTECT YOUR IDEAS

Take the First Step Today—Action Counts

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

No Charge for Information on How to Proceed

The booklet shown here contains valuable information relating to patent proceedure that every inventor should have. And with it I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims

Practice confined exclusively to Patents, Trademarks, and Copyrights

Mail this Coupon NOW.

CLARENCE A. O'BRIEN
Registered Patent Attorney,
53-L Security Savings & Commercial Bank Bldg., Washington, D. C.

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name .....

Address .....

.....

(Important: Print or Write name clearly)

His Salary Was Raised

while others were reduced

"Up to the time I enrolled for a course with the International Correspondence Schools, I had only a grade-school education. Since enrolling, I have advanced to a much better position, where my salary is nearly four times as much as I was making previously. I would not be able to hold my present position had I not taken your Course. Recently I received a nice increase in salary, while other men were being reduced."

Read that last sentence again—"Recently I received a nice increase in salary, while other men were being reduced."

There could be no better proof of the value of an I. C. S. course than that. It shows that the trained man is given preference over all others and paid more money, even in slack times, if his work deserves it. It shows that there are always bigger, better jobs open for men who have the foresight to prepare for them in spare time.

Why don't you study and get ready too? We'll be glad to help you if you will only make the start. Choose the work you like best in the coupon below; then mark and mail it to the I. C. S. today. This doesn't obligate you in the least, but it will bring you information that will start you on a successful career. This is your opportunity.

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6161E, Scranton, Penna.

Oldest and largest correspondence schools in the world

Without cost, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....
Street Address.....
City.....State.....
Occupation.....
6-26-25

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

LAW STUDY AT HOME

Become a lawyer. Legally trained men win high positions and big success in business and public life. Be independent. Greater opportunities now than ever before. Big corporations are headed by men with legal training. Earn

$5,000 to $10,000 Annually

We guide you step by step. You can train at home during spare time. Degree of LL.B. conferred. LaSalle students found among practicing attorneys of every state. We furnish all text material, including fourteen-volume Law Library. Low cost, easy terms. Get our valuable 108-page "Law Guide" and "Evidence" books free. Send for them NOW.

LaSalle Extension University, Dept. 9384-L Chicago

The World's Largest Business Training Institution

INVENTIONS WANTED

Which are simple to manufacture and possible of volume distribution through national sales organization. Cash or royalty basis. Submit full description. United Factories Bureau, 218 Woodward Building, Washington, D. C.

Insure your copy reaching you each month. Subscribe to SCIENCE & INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., New York City.

Into the Fourth Dimension

By RAY CUMMINGS

(*Continued from page* 419)

In late July the thing took another turn. A new era began—a sinister era which showed the necessity for something more than all this aimless talk. Four men were walking one night along a quiet country road near a small English village. They were men of maturity, reputable, sober, middle-aged citizens. Upon the road level they observed the spectres of four or five male figures, which instead of remaining motionless rushed forward to the attack. These ghosts were ponderable! The men distinctly felt them; a vague feeling, indescribable, perhaps as though something soft had brushed them. The fight, if such it could be called, amounted to nothing. The men flailed their arms in sudden fear; and the apparitions sped away. Greenish, more solid-looking than those heretofore seen.

This was more than mere visibility—an actual encounter. These four men were of the type who could be believed. The report was reliable. And the next night, in a Kansas farm-house, the farmer and his wife were awakened by the scream of their adolescent daughter. They rushed into her bedroom. She was in bed, and bending over her was the apparition of a man. Its fingers were holding a lock of the girl's long black hair. At the farmer's shout, the ghost turned; its hand was raised—and the farmer and his wife both saw that the shadowy fingers had *lifted the girl's tresses* which they were clutching. Then it dropped them and moved away, not through the walls of the room, but out *through the open window.*

The girl was dead. She had suffered from heart trouble; was dead of fright, undoubtedly. It was the beginning of the era of menace. And that next afternoon Wilton Grant telephoned me. His voice had a strange tenseness to it, though it was grave and melodious as always.

"Come out and see us this evening, will you Rob?"

"Why yes," I said. I had not seen them for over a month—an estrangement which I had not understood and which hurt me terribly, had fallen between us. "Of course I will," I added. "How's Bee?"

"She's been quite ill . . . No, not dangerous, she's better now. Don't fail us, Rob.

Will stooped down and passed his hand slowly through the face. " 'You can feel nothing. It has visibility—that property only in common with us. Try it.' " I forced my hand down to the thing, held it there. It was like putting one's fingers into a dim area of light.

PATENTS

TRADE MARKS · DESIGNS
FOREIGN PATENTS

MUNN & Co.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

1518 Scientific American Bldg., *New York City*
525 Scientific American Bldg., *Washington, D.C.*
1314 Tower Building, *Chicago, Ill.*
667 Hobart Building, *San Francisco, Cal.*
522 Van Nuys Building, *Los Angeles, Cal.*

Books and Information on Patents and Trade Marks by Request.

INVENTIONS Commercialized

ON A CASH OR ROYALTY BASIS
PATENTED or UNPATENTED

In Business 25 Years - Complete Facilities - References.

Write ADAM FISHER MFG. Co.,
205D Enright Ave. St. Louis, Mo.

PATENTS

BOOKLET FREE — HIGHEST REFERENCES
PROMPTNESS ASSURED — BEST RESULTS

Send drawing or model for examination and report as to patentability

WATSON E. COLEMAN, Patent Lawyer
644 G Street, N. W., Washington, D. C.

PATENTS

PROMPTLY PROCURED. SEND A SKETCH OF YOUR INVENTION.

FREE INVENTION RECORDING BLANK

FREE BOOK — Z. H POLACHEK — PATENT ATTORNEY CONSULTING ENGINEER — 70 WALL ST. NEW YORK

NAME_____

ADDRESS_____

MAIL TODAY

C. L. PARKER

Ex-Examiner U. S. Patent Office

Attorney-at-Law and Solicitor of Patents

McGill Building, Washington, D. C.

Patent, Trade Mark and Copyright Law

PATENTS As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent-Sense, free.
Lacey & Lacey, 644 F St., Washington, D. C. Estab. 1869

Book on Law Free

Write today for this new book. It tells you how a law training will shorten your road to success. It also carries a vital and inspiring message to every ambitious man. Find out about the opportunities that await the law trained man. Find out how you can learn law right in your own home. No obligations. The book is absolutely free. Write Today—now while we are making a special reduced tuition offer.

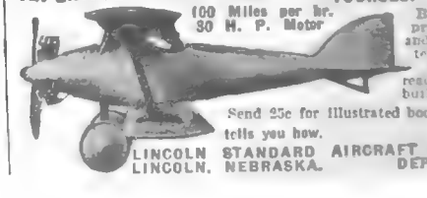
American Correspondence School of Law
3601 Michigan Ave. Dept. 1426, Chicago, Ill.

BLUE BOOK ON PATENTS

and Priority Record blank gratis.
MONROE E. MILLER, PATENT LAWYER,
411-6 Ouray Building, WASHINGTON, D. C.
ELECTRICAL AND MECHANICAL EXPERT

PATENTS TRADE-MARKS
Edward C. Sasnett, Attorney at Law
Ex-Principal Examiner U. S. Patent Office; Electrical Expert — Personal Service
544 McGILL BLDG. WASHINGTON, D. C.

The LINCOLN SPORT PLANE BUILD AND FLY IT YOURSELF



100 Miles per hr. 30 H. P. Motor

Blue prints and materials ready to builder

Send 25c for illustrated book it tells you how.

LINCOLN STANDARD AIRCRAFT CO. DEPT. I
LINCOLN, NEBRASKA.

About eight o'clock? . . . That's fine. We —I need you. You've been a mighty good friend, letting us treat you the way we have——"

He hung up. With an ominous sense of danger hanging over me, I went out to see them at the hour he had named.

CHAPTER II

Groping at the Unknown

Wilton Grant was at that time just under forty. He was a tall spare man of muscular build, lean but powerful. His smooth-shaven face was large-featured, rough-hewn, with a shock of brown hair above it—hair turning grey at the temples. Beneath heavy brows his grey eyes were deep-set, somber. His ruddy-brown complexion, the obvious strength of his frame at a quick glance gave him an out-of-doors look; a woodsman cast in the mould of a gentleman. Yet there was something poetic about him as well; that wavy, unruly hair, the brooding quality of his eyes. When he spoke, those eyes frequently twinkled with the good-nature characteristic of him. But in repose, the somberness was there unmistakable; an unvoiced, brooding melancholy.

Articles in Radio News for September

Television, an Accomplished Fact, by A. Dinsdale.

Audio Amplification For the Beginner, by A. P. Peck.

Radio-Operated Furnace Melts Precious Metals, by S. R. Winters.

Alleviation of Static, by L. W. Hatry.

Newest Discoveries In the Range of Ultra-Shortest Waves, by Prof. Boris Weinberg.

Overloading the Audio Amplifier, by Sylvan Harris.

A New Idea In Set Construction, by Joseph Riley.

Yet there was nothing morbid about Wilton Grant. A wholesomeness, mental and physical, radiated from him. He was a jolly companion, a man of intellectuality and culture. His deep voice had a pleasing resonance suggestive of the public speaker. Normally rather silent, chary of speech, he could upon occasion draw fluently from a vocabulary of which many an orator would be proud.

He was a bachelor. I often wondered why, for he seemed of a type that would be immensely attractive to women. He did not avoid them; the pose of a woman-hater would have been abhorrent to him. Yet no woman to my knowledge had ever interested him, even mildly. Except his sister. They were orphans and she was his constant companion. They were both in fact, rather chary of friends; absorbed in their work, in which she took an active part. Their home and laboratory was an unpretentious frame cottage in a Westchester village of suburban New York. They lived quietly, modestly, with only one automobile, and no 'plane.

Will opened the door for me himself, smiling as he extended his big, hearty hand. "Well! You came, Rob? You're very forgiving—that's the mark of a true friend." He led me into the old-fashioned sitting room. "I'm not going to apologize—"

"Don't," I said. "I knew of course you had some reason—"

PATENTS TRADE-MARKS AND COPYRIGHTS

OUR OFFER: FOR THE PROTECTION OF YOUR INVENTION

YOUR FIRST STEP before disclosing an invention. The inventor should write for our blank form—

"Record of Invention"

This should be signed and witnessed and returned to us together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS.

NO CHARGE FOR THE ABOVE INFORMATION

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE MARK BOOK

Shows value and necessity of Trade Mark Protection. Information regarding *Trade Marks and unfair competition in trade.*

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors.

IMPORTANT

Do not submit your invention to anyone before you furnish proof that the invention is patentable or application has been filed. IN ORDER TO HAVE YOUR CASE MADE SPECIAL TO AVOID DELAY YOU SHOULD TAKE THE PRECAUTION OF HAVING YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and secure early filing date in Patent Office. To secure special preparation of your case send $25.00 on account with model, sketch and description of your invention.

All communications and Data Strictly Confidential. Interference and Infringement Suits Prosecuted. Our Organization offers PERSONAL SERVICE by Experienced Patent Solicitors and Draftsmen.

We Regard a Satisfied Client as our best advertisement, and furnish anyone, upon request, lists of clients in any state for whom we have secured patents.

Highest References—Prompt Attention—Reasonable Terms

WRITE TODAY

FREE COUPON

VICTOR J. EVANS & CO., *Patent Attorneys*

New York Offices 1007 Woolworth Bldg. Philadelphia Offices 714-715 Liberty Bldg. Pittsburgh Offices 514 Empire Bldg.
Chicago Offices, 1114 Tacoma Bldg. San Francisco Offices, Hobart Bldg.

Main Offices, 779 Ninth Street, Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name..... Address.....

Thousands Can Draw CARTOONS Who Have Never Even Tried

Cartoonists earn from $60 to far over $300 a week. Why tie yourself to work that is drudgery when through a remarkable easy method you can easily learn at home in spare time to draw cartoons that SELL?

MANY are earning pitifully small salaries who could make wonderful salaries in cartooning. Briggs, Fox, Fisher, Goldberg and other leading cartoonists *earn more than the president of many corporations.* Yet a few years ago many of our most successful cartoonists never dreamed they could draw a good cartoon!

The World's Easiest, Pleasantest and Best Paying Profession

Just watch a cartoonist work. A few little lines—a couple of simple curves—a splash of black here and there—and then you see a splendid cartoon before you. With a few strokes of his pen, he has taken some little incident of his day's experience—some humorous or sad scene he has witnessed—and produced a wonderful cartoon.

Quick Easy Way to Learn Cartooning

This fascinating ability to draw cartoons can now easily be *yours*—this ability which can mean so much real pleasure and profit to you. Through a wonderful easy method you receive right at home through the mail a complete training in Cartoon Making, and *personal corrections on all* of your work from successful cartooning instructors.

With their help, you can in an amazingly short time, learn to draw the comic strips, humorous, political and animated cartoons which are in such big demand.

Learn More About Cartooning Send for FREE BOOK

Never have cartoons been so popular. Millions of dollars were spent last year on cartoons of all kinds—and every week newspapers increase the amount of cartoons used. Get full details on the amazing opportunities in this fast growing field of Cartooning and full information on this remarkable home study method. Mail coupon for FREE BOOKLET *today*. WASHINGTON SCHOOL OF CARTOONING, Room 269-D, 1113—15th St., N. W., Washington, D. C.

WASHINGTON SCHOOL OF CARTOONING,
Room 269-D, 1113—15th St., N.W., Washington, D. C.

Please send me without obligation your illustrated FREE BOOKLET on Cartooning and details of Special Offer to new students.

Name .....
(Write name plainly—State Mr., Mrs., or Miss)

Address .....

City ..... State.....

If under 16 years, please state age.....

"Then, early in March, the second ghost was reported. In the Eastern Hemisphere this time. It was discovered in midair, near the Boro Badue, in Java. Thousands of people watched it for over an hour that evening. It was the figure of a man, seated on something invisible in the air nearly a hundred feet above ground. It sat motionless as though contemplating the crowd of watchers beneath it. And then it was joined by other figures! Another man, and a woman."

We were seated. He said with a nod, "Yes. A reason—you'll hear it now—tonight—"

His voice trailed away. It made my heart beat faster. He had changed. I saw him suddenly older.

"Where's Bee?" I asked out of the silence.

He jerked himself back from his reverie. "Upstairs. She'll be down in a moment. She's been ill, Rob."

"But you said not seriously."

"No. She's better now. It's been largely mental—she's been frightened, Rob. A terrible strain—that's why I thought it better for us to isolate ourselves for a while—"

"Oh, then that's why—"

He was deprecating, apologetic. "That's why I wrote you so peremptorily not to come to see us any more. I was upset myself, I needn't have been so crude—"

"Please don't apologize, Will. I—I didn't understand, but—"

"I'm not. I'm just telling you. But now Bee thought we should have you with us. Our best friend, you understand? And it will make things easier for her—naturally she's frightened—"

My hand went to his arm. What I had meant to say I do not know, for Bee at that moment entered the room. A girl of twenty-four. Tall, slim and graceful. Her long chestnut hair, which usually she wore in the prevailing mode coiled upon her head, now hung in braids. She was a beautiful girl.

She was dressed now in a clinging negligee which seemed to accentuate the slim grace of her. But the marks of illness were plain upon her face; a pallor; her eyes, though they smiled at me with the smile of greeting upon her lips, had the light of fear in them; her hand as I took it was chill, and its fingers felt thin and wan.

"Bee!"

"It's good to see you, Rob. Will has been apologizing for us, I suppose—"

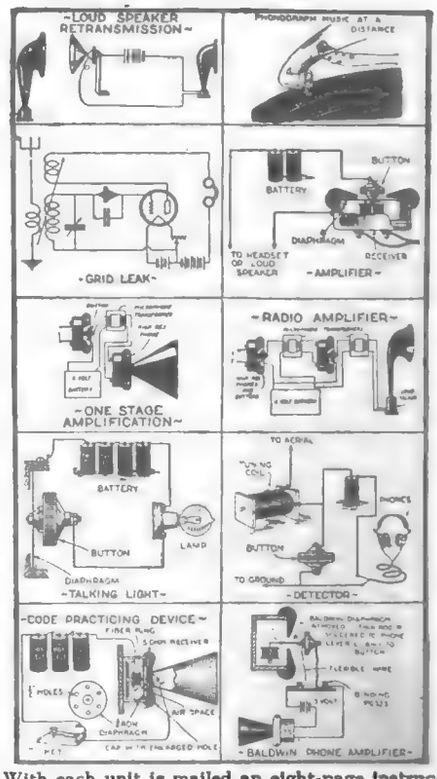
These friends of mine calling me to them in their hour of need. I had been annoyed, hurt; I had not realized how deep was my affection for them . . . for Bee . . . Vaguely I wondered now if their trouble—this fear that lay so obviously upon them both—concerned the coming of the ghosts. . .

Bee sat close beside me, as though by my nearness she felt a measure of protection.

Thousands Use These Ingenious TRANSMITTER UNITS

Here's a marvel of Engineering design—a practical miniature transmitter, used by thousands of radio fans and experimenters for amplification purposes.
It is a most novel unit, having hundreds of uses. Every amateur should have two or three of these amplifiers in his laboratory.

A FEW USES FOR THESE UNITS



With each unit is mailed an eight-page instruction pamphlet containing suggestions for innumerable uses.
Our supply is limited; avoid disappointment by ordering today. The coupon below is for your special convenience.

SPECIALLY PRICED

While they last— (or Two for $1.75) **95c** per unit

THE PRESS GUILD,
66-S West Broadway, New York, N. Y.

Enclosed find 95c/$1.75 for which send me postpaid one/two amplifier units as advertised.

Name .....

Address .....

City, State .....

Will faced us. For a moment he was silent. Then he began, "I have a good deal to say, Rob—I want to be brief—"

I interrupted impulsively, "Just tell me this. It is—does it, this thing whatever it is—does it concern the ghosts?"

I was aware of a shudder that ran over Bee. Will did not move. "Yes," he said. "It does. And these ghosts have changed. We knew they would—we've been expecting it."

"That poor girl," Bee said softly. "Dead—dead in her bed of fright. You read about it, Rob?"

"A menace," Will went on. "The world is just realizing it now. Ghosts, changing from shadow to substance—" He stopped, then added abruptly, "We've never told you much about our work—our business—have we? Reticent, peculiar friends—"

They had in truth always been reticent. I had never been in their laboratory. They were engaged I understood, chiefly with soil analysis; sometimes people would come out to consult them. Beyond such a meager idea I knew nothing about it.

Will said abruptly, "Our real work we have never told anyone. It concerns—well, a research into realms of chemistry and physics unknown. I have been delving into it for nearly ten years, and then Bee grew old enough to help me. We've made progress—" His smile was very queer. "Tonight—I'm ready to show you something that I can do."

They seemed to torture Bee, these words of her brother's. I heard the sharp intake of her breath, saw her white fingers locked tensely in her lap.

"Not—not tonight, Will."

"Tonight—as good a night as any other . . . Rob, would it surprise you to know we anticipated the coming of the ghosts years ago? Not that they would come, but the possibility of it. Ghosts! What do *you* think they are, Rob?"

"Why ghosts—ghosts are—"

"Spirits of the dead made visible?" His manner was suddenly vehement; his tone contemptuous. "Earth-bound spirits! Astral bodies housing souls whose human bodies are in their graves! Rubbish! These are not that sort of ghosts."

I stammered, "But then—what are they?"

"Call them ghosts, the word is as good as any other." His voice grew calmer; he went on earnestly, "I want you to understand me—it's necessary—and yet I must not be too technical with you, too abstruse. Let me ask you this—you'll see in a moment that none of this is irrevelant. How many dimensions has a point?"

At my puzzled look he smiled. "I'd better not question you, Rob, but you won't find me hard to understand. A point—an infinitesi-

Station
WRNY
NEW YORK
374.8 Meters - 800 kilocycles
is owned and operated by the publishers of this magazine
Our Editors will talk to you several times every week-
See your Newspaper for details
TUNE IN ON WRNY

FREE if you order now

To all who subscribe to this pay raising set *now* we will give a copy of Bishop's Electrical Drafting and Design, a great book that tells you everything you want to know about the preparation, reading and use of all kinds of electrical diagrams and drawings. It tells you how to handle electrical plans and blueprints. It shows you how to put your own ideas into correct drawing form. It is a book no man would expect to get free—it comes to you with the Croft Library as a premium for promptness.

7c a day

Raise your pay with these books

BIG salaries are paid in the electrical field for expert knowledge. The man who knows electricity in all its many phases—the man who has completely mastered the subject from A to Z—can pick his own job and name his own salary. The only way you can earn more is to learn more. Small knowledge means small pay. Learn the way to bigger pay. Become an expert. Croft will show you how.

Croft Library of Practical Electricity

8 volumes—3000 pages—2100 illustrations—flexible keratol—small monthly payments

Everywhere the Croft Library is acknowledged as the standard—the leader—in practical electrical training. In the Croft books you will find complete, detailed and up-to-the-minute information on all phases of electricity, motors, generators, armatures, commutators, transformers, circuits, currents, switchboards, distribution systems—electrical machinery of every type—wiring for light and power—how to do it mechanically perfect, in accordance with the National Electrical Code—wiring of finished buildings—underwriters' and municipal requirements—how to do a complete wiring job, from estimating it to completion—illumination in its every phase—the latest and most improved methods of lighting—lamps and lighting effects, etc.

Know electricity as experts know it and get an expert's pay

Fit yourself for a bigger position by knowing electrical practice complete—inside and outside work—central stations and the whole subject. Croft will teach you. He will take you in quick, easy steps from the simplest principles to the complete and economical operation of a great central station. The Croft-trained man wins because he knows the "why" and the "how" of modern electrical practice. Croft has been through the mill. His knowledge has been gained by shirt sleeve contact with electrical problems. He has worked his way up from the bottom to the top—from apprentice lineman to electrical engineer for one of the great electrical manufacturing companies. Now he heads his own consulting company, and his name is known in every corner of the electrical world. He is the one man above all others who can show you the way to permanent success.

Examine these pay-raising books free

We want you to test our statement—we want you to compare Croft books with others. Fill in and mail the coupon attached and we will send you the entire set of eight volumes for ten days' Free Examination. We take all the risk—pay all charges. You assume no obligation—you pay nothing unless you decide to keep the books. Then $1.50 in ten days and the balance at the rate of $2 a month. Send the coupon NOW and see the books for yourself. When your first payment of $1.50 is received we will send you your free copy of Bishop's Electrical Drafting and Design.

Send no money —just the coupon

McGraw-Hill Book Co., Inc.,
370 Seventh Avenue
New York.

Gentlemen—Please send me the CROFT LIBRARY OF PRACTICAL ELECTRICITY (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send $1.50 in ten days and $2.00 per month until $19.50 has been paid. If not wanted, I will write you for return shipping instructions. Upon receipt of my first payment of $1.50 I am to receive a copy of Bishop's Electrical Drafting and Design without additional charge. (Write plainly and fill in all lines.)

Name .....

Home Address .....

City and State .....

Employed by .....

Occupation SI-9-1-26

Make Your Salary $100.00 a Week

Everywhere there is a big demand for artists—newspapers, magazines, advertising agencies, department stores, everyone who advertises is glad to pay big money for artists who can produce pictures and illustrations with commercial value.

Learn At Home This Quick Easy Way

Our wonderful method makes it possible for anyone to learn Illustrating, Cartooning, or Commercial Art. Most of our students never touched a drawing pencil before they studied with us, yet many of them are now making splendid incomes. You can do the same. The simplicity of this amazingly quick way will astonish you. No matter what your present ability—no matter whether you think you have "talent" or not—we can teach you to draw—and draw well.

Simple Way Makes Success Easy

Our easy way simplifies everything. You start drawing with straight lines, then you begin using curves, and before you realize it you are drawing pictures with shading, action and perspective. And you are taught all the "inside secrets"—the "tricks of the trade" that would otherwise take you years to learn. Our successful art instructors have had years of experience in commercial art. They know the kind of pictures that sell and teach you how to make them—in the least possible time.

Write for FREE BOOK

An interesting and handsomely illustrated booklet, "Quick Easy Way to Become an Artist," will be sent you without cost.

Mail this coupon for it. Learn how you can easily become an artist in your spare time. Get also full particulars about our "Artist's Outfit" offer to new students. Send the coupon NOW!

The Washington School of Art, Inc.
Room 269-D, 1115—15th St., N. W., Washington, D. C.

The Washington School of Art, Inc.,
Room 269-D, 1115—15th St., N. W.,
Washington, D. C.

Please send me without cost or obligation on my part your free book, "Quick Easy Way to Become an Artist." Print name plainly.

Name .....
(Mr., Mrs., Miss)

Address .....

City ..... State.....

mal point in space—has no dimension. It has only *location*. That's clear, isn't it? A line has one dimension—length. A plane surface has length and breadth; a cube, length, breadth and thickness. The world of the cube, Rob, is the world we think we live in—the world of three dimensions. You've heard of that intangible something they call the fourth dimension? We think it does not concern us—but it does. We ourselves have four dimensions. *We are the world of the fourth dimension.* But the fourth is not so readily understood as the other three."

He paused for an instant, then added, "The fourth dimension is time, Rob. Not a new conception to scientists—think a moment—how would you define time?"

"Time," I said, "Well, I read somewhere that time is what keeps everything from happening at once."

He did not smile. "Quite so. It is something in the universe of our consciousness along which we progress in measured rate from birth to death—from the beginning to the end."

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

.....

To ..... Newsdealer

Address .....

Please reserve for me.....copies of SCIENCE & INVENTION every month until I notify you otherwise, and greatly oblige,

Name .....

Address .....

Bee murmured, "And beyond death there is no time."

He ignored her. "We are living in a four-dimensional world—a world of length, breadth, thickness and time. The first three, to our human perceptions, have always been linked together. Time—I do not know why—seems to our minds something essentially different. Yet it is not. Our universe is a blending of all four.

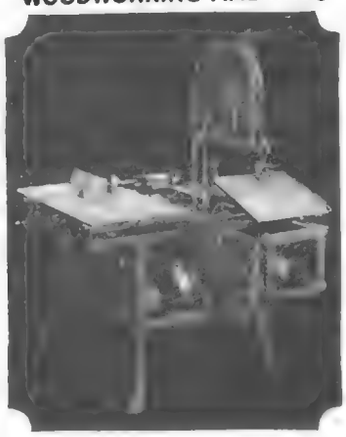
"Let me give you an example. That book there on the table—it exists because it has length, breadth and thickness. But Rob, it also has *duration*. It is matter, persisting both in space and in time. You see how the element time, is involved? I'll go further. We know that two material bodies cannot occupy the same space *at the same time*. With three of the dimensions only—that is, if theoretically we remove the identical time-factor—they do *not* conflict. You're confused, Rob?"

"I'm not quite sure what you're aiming at," I said.

"You'll understand in a moment. Matter, as we know it, is merely a question of vibration. It is, isn't it?"

PARKS

WOODWORKING MACHINES



Cabinet Shop Special

$290 with motor

See this PARKS this month!

September and October are "Parks Cabinet Shop Special months" with Parks dealers everywhere. In their showrooms this wonderfully popular woodworker will be on display and in many instances in actual operation.

Parks Cabinet Shop Special No. 10 at $290.00 is the handiest machine Parks ever built! Big enough to turn out first-class work—small enough to fit in a small shop or your basement—a real machine built for real work without freakish "stunt" designing. It makes practically any cut and includes rip and cut-off circular saw, jointer, and band saw. Lathe and shaper may be added at small extra cost. Every man who does cabinet making or woodworking of any kind wants this splendid machine. It is the biggest woodworking machinery value on the market today. Be sure to see this Parks this month.

in these dealers' showrooms

ALA: Moore, Handley, Hwde. Co., Birmingham; McGowin-Lyons Hwde. & Supply Co., Mobile; Alabama Mchy. & Supply Co., Montgomery; ARK: Ben D. Schaad Mchy. Co., Little Rock; CAL: Shaw-Palmer & Bakewell Co., Los Angeles; Harron-Rickard & McCone Co., San Francisco; COLO: H. W. Moore Equipment Co., Denver; CONN: Lunt, Jillson Co., Manchester; FLA: Cameron & Barkley Co., Jacksonville; Cameron & Barkley Co., Miami; Cameron & Barkley Co., Tampa; GA: R. S. Armstrong & Bros. Co., Atlanta; ILL: Woodworkers' Tool Works, Chicago; KY: Roy C. Whayne Supply Co., Louisville; LA: Clark D. Shaughnessy Co., New Orleans; MASS: Lunt, Jillson Co., Boston; MICH: Riverside Mchy. Depot, Detroit; McMullen Mchy. Co., Grand Rapids; MINN: Raymer Hwde. Co., St. Paul; MO: Standard Tool & Supply Co., Kansas City; S. T. Hatcher & Co., St. Louis; NEB: Diehl Mchy. & Supply Co., Omaha; N. Y.: Interstate Mchy. Co., Troy; Chas. E. Mapps, 178 Lafayette St., New York City; N. H. Bracket & Shaw Co., Somersworth; N. CAR: Amer. Hwde. & Equip. Co., Charlotte; Raleigh Iron Works Co., Raleigh; OHIO: J. C. Baker, Columbus; OKLA: Universal Supply & Mchy.Co.; Tulsa; ORE: Portland Mchy Co., Portland; PA: K. O. Ditmars, Bourse Bldg., Philadelphia; Cobienz Tool & Supply Co., Erie; S. CAR: Cameron & Barkley Co., Charleston; TENN: Peglar Mchy. Co., Chattanooga; Iddins Mchy. Co., Knoxville; Harvill Supply Co., Nashville; Carriage & Wagon Supply Co., Memphis; TEX: Universal Supply & Mchy. Co., Amarillo; Southern Implement Supply Co., Dallas; Don A. Carpenter & Co., El Paso; Pedan Iron & Steel Co., Houston; Pedan Iron & Steel Co., San Antonio; UTAH: Salt Lake Hwde. Co., Salt Lake; VA: James McGraw, Inc., Richmond; W. VA: LaLance Equip. Co., Huntington; WIS: Shadbolt & Boyd Co., Milwaukee; WASH: Union Mchy. & Supply Co., Seattle; FOREIGN: Sipe Mchy. Agency, San Jose; Costa Rica; P. I. Zayas, Havana, Cuba; Weir Mchy. Co., Vancouver, B. C.; Morris, Black & Matheson, Ltd., Auckland, N. Z.; West India Mchy. & Supply Co., San Juan, P. R.; Bournival & Co., Montreal, Can.; Engineering Supply Co. of Australia, Ltd., Brisbane, Australia.

See this Parks by all means! If you can't, then write us for circular No. 10 and the new Parks catalog.

The Parks Ball Bearing Machine Co.,
CINCINNATI, OHIO
Canadian Factory: 200 Notre Dame East, Montreal, Can.

BIG SURPRISES —FOR YOU—

Great Mind Reading Mystery! Different from anything you've ever seen. Don't miss it! Price 10c.

Thousands of Unique Mystifying Tricks. Novelties—All kinds —All prices are ready for you.

Genuine and Trick Rings, Jewelry, Disappearing Cards, Fun Making Things—Telescopes, Pistols, Magic of all Kinds.

WRITE FOR OUR 164 PAGE CATALOG

AMERICAN BAZAAR, INC.,
640 BROADWAY NEW YORK, N. Y.

"I know light is vibration," I responded. "And sound. And heat, and—"

He interrupted me. "The very essence of matter is vibration. Do you know of what matter is composed? What is the fundamental substance? Let us see. First, we find matter is composed only of molecules. They are substances, vibrating in space. But of what are molecules composed? Atoms, vibrating in space. Atoms are substance. Of what are *they* composed?"

"Electrons?" I said dubiously.

"Protons and rings of electrons. Let us cling to substance, Rob. These electrons are merely negative, disembodied electricity—not matter, but mere vibration. They—these electrons—revolve around a central, positive nucleus. This then, is all the substance that matter has. But when you penetrate this inner nucleus, what do you find? Substance? Not at all. This proton, as they sometimes term it, this last inner stronghold of substance, is itself a mere vortex—a whirlpool in space!"

I groped at the thought. Matter, substance, everything tangible in my whole conscious universe, robbed of its entity, reduced to mere vibration in empty space. Vibration of what? I knew that there was no human mind to give the answer.

"It's appalling, Rob, the unreality of everything. Metaphysicians say that nothing exists save in the perception of it by our human senses. . . I was talking of the dimension, time. It is the indispensable factor of vibration. That's obvious. Motion is nothing but the simultaneous change of matter in space and time. You see how blended all the factors are? You cannot deal with one without the others. And mark you this, Rob—you can subdivide matter until it becomes a mere vortex in empty space. Can you wonder then—"

I had noticed Bee gazing intently across the room. "Will!" she said suddenly; her voice was hardly more than a whisper of repulsion. "It's there now, Will!"

The room was brightly illumined by a cluster of globes near the ceiling. Will left his seat, calmly, unhurried, and switched them off. There was only the small table electrolier left lighted. It cast a yellow circle of light downward; most of the room was in shadow. And over in a corner I

$5,000 for Perpetual Motion

When SCIENCE AND INVENTION Magazine was still in its infancy, the editors denied the possibility of constructing a perpetual motion machine using those forces of nature as we now know them.

Since that time the editors have received thousands of different designs for perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.-00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Amazing New Facts About Old Age

"Did you know that two-thirds of all men past a certain middle age suffer with a certain seldom mentioned disorder?

"By the medical profession this is known as hypertrophy of the prostate gland. And scientists have now revealed that it is directly responsible for much of what many people mistake for actual old age.

NEW HYGIENE

But no longer should men approaching or past the prime of life put up with these painful and embarrassing conditions due to this cause. For a well known American scientist has discovered a new, safe home treatment for this gland trouble—a new kind of hygiene that goes right to the seat of this trouble, often bringing new pep and vigor to the entire body.

MIDDLE AGE AILMENTS

Here is usually quick relief for such distressing ailments as sciatica, aches in back, legs and feet nervousness and irritability, when due to enlarged prostate.

Twenty thousand men testify to the value of this treatment.

FEEL TEN YEARS YOUNGER IN SIX DAYS OR PAY NOTHING

So successful have been the results of this new hygiene in thousands of cases that the discoverer offers to send it to any man under the amazing guarantee that unless you feel 10 years younger in 6 days you pay nothing. There are no drugs to swallow—no exercises, diets or lessons.

ALL EXPLAINED IN FREE BOOK

If you are troubled with any of the disorders mentioned, if you have chronic constipation or this trouble, you should send for a vitally interesting free book, written by this scientist called, "Why Many Men Are Old At 40." It describes this splendid treatment and shows how you may often regain much of your youthful vigor and be free from certain disorders. No obligation. Simply fill out and mail the coupon below.

W. J. KIRK
4561 Main Street Steubenville, Ohio

A Test Every Man Past 40 Should Make FREE

The coupon herewith will bring you FREE a vitally interesting booklet which will enable you to ask yourself certain questions which show you the true state of your physical condition. Fill out and mail the coupon immediately.

MR. W. J. KIRK
4561 Main Street
Steubenville, Ohio

Send me, free without obligation, your booklet, "Why Many Men Are Old At 40."

Name .....

Address .....

City..... State.....

Western Office: Suite 4[illegible] Nuys Bldg., Los

"They've tripled your salary, dear"

"I TELL you, Tom, it was a lucky day for both of us when you sent in that I. C. S. coupon. You'd never be where you are to-day if you hadn't decided to study in spare time just when you did."

Spare-time study with the I. C. S. is winning promotions for thousands of men and bringing happiness to thousands of homes all over the world. In offices, shops, stores, mines, mills and on railroads, I. C. S. trained men are stepping up to big jobs, over the heads of older men, past those whose only qualification is long service. There is a job ahead of YOU. Some man is going to be picked for it. The boss can't take chances. He is going to choose a trained man with sound, practical knowledge of the work.

Get busy right now and put yourself in line for that promotion. You can do it in spare time in your own home through the International Correspondence Schools, just as thousands of other men and women have done.

The first step they took was to mark and mail this coupon. Make *your* start the same way—and make it right now.

Mail the coupon today for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6164-E, Scranton, Penna.
Oldest and largest correspondence schools in the world
Without cost, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....
Street
Address.....
City ..... State.....
Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

ATTENTION!

The Ross Radio ring is a miniature crystal radio receiving set. Wear it as a ring—use it as a radio. With a phone and aerial brings in local stations clearly and distinctly. Results guaranteed or money refunded.

PRICE 50c. POSTPAID

AMERICAN BAZAAR, INC.
Radio Department
640 BROADWAY, NEW YORK CITY

guides your hand; corrects . . Big improvement in three mplete outline FREE.
t. 44 St. Louis, Mo.

saw the glowing apparition of a recumbent man no more than ten feet from us.

Will said, "Come here, Rob—let me show you this." His voice was grave and unflurried. As I crossed the room hesitatingly, Bee was with me, forcing herself to calmness. She said, "It's here most of the time. Watching us! It seems to be on guard—watching—always—"

Will drew me beside him. Together we stood within a foot of the spectre. It took my courage, but after a moment the grewsome element seemed to leave me for Will stood as though the thing were a museum specimen, explaining it.

I saw, so far as I can put the sight into words, the vibrating white shape of a man reclining on one elbow. It was slightly below the level of the floor, most of it within or behind the floor, the outlines of which were plainer than the apparition mingled with them. The head and shoulders were raised about to the level of our ankles.

A man? I could not call it that. Yet there was a face which after a moment I could have sworn was human-featured; I could almost think I saw its eyes, staring at me intently.

Will stooped down and passed his hand slowly through the face. "You can feel nothing. It has visibility—that property only in common with us. Try it."

I forced my hand down to the thing, held it there. It was like putting one's fingers into a dim area of light.

"Is it—it is alive?" I asked.

"Alive?" Will's tone was grim. "That depends on what you mean by alive. It can reason, if that answers you."

To Readers of
"THE EXPERIMENTER"

You will find the best features of THE EXPERIMENTER preserved in SCIENCE & INVENTION, besides a brand new "Model Department". See the beautiful Silver Trophy cup for best model each month described elsewhere in this issue.

"I mean—can it move?"

"It moves," said Bee. "It watches us—follows us—" She shuddered.

The details of the figure? I stepped back to see it better. It seemed now a man clothed in normal garments . . . a malevolent face, with eyes watching me. . . Was that face my imagination, or did I really see it?

I must have stammered my thoughts aloud, for Will said, "What we see, and what really exists, has puzzled metaphysicians for centuries. Who knows what this thing really looks like? You do not, nor do I. Our minds are capable of visualizing things only within the limits of an accustomed mould. You see that thing as a man of fairly human aspect, and so do I. The details are elusive; but stare at them for a day and your imagination will supply them all. That's what you do in infancy with the whole material world about you—mould it to fit our human perceptions. But what everything really looks like—what this thing here might appear in actuality to a mind omniscient—who can tell?"

"Can it—can it hear us?" I demanded.

"No—I do not think so. It can see us, no more. And it has no fear." With a belligerent gesture he added humorously, "Get up, you, or I'll wring your neck!"

"Will, don't joke like that!" Bee protested.

He turned away and switched on the main lights. I could still see the thing there, but now it was paler—wan like starlight before the coming dawn. Will turned his back on it and sat down. His face had gone solemn again.

ADVICE
that saves money in NEW YORK

FOR real comfort, unusual convenience and genuine economy — stop at the Martinique—no New York Hotel offers more to the conservative visitor who demands clean, comfortable accommodations at moderate prices—rates start at $2.50 per day.

—Take our advice. Investigate! We'll welcome you—and do our best to prove it!

A. E. Singleton
Resident Manager

Hotel MARTINIQUE
Affiliated with Hotel McAlpin
BROADWAY 32nd to 33rd STREETS
NEW YORK CITY

Home Made Candies for Profit

The Candy Business is about the only business where the little fellow has the big fellow at a disadvantage. Turn your kitchen, basement or spare room into a small candy shop and start making a handsome income almost from the very first day. Many now rich started with no capital. Trade secrets taught by man who made big success himself.

CAPITOL CANDY SCHOOL, Dept. K-9,
631 Penna Ave., N. W., Washington, D. C.

"HANDS UP" LOOKS LIKE A REAL AUTOMATIC

Protect your home. New Style Automatic. No Permit Necessary. Absolutely Safe and Harmless Pull Trigger. Top opens revealing Cigarette Case or holder for Hip Flask, Powder Puff, Coin Purse, etc. SEND NO MONEY. Pay postman $1.79 plus postage. $1.79

FEDERAL MAIL ORDER CORPORATION
414 Broadway, New York. Dept. X80

Insure your copy reaching you each month. Subscribe to SCIENCE & INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

"These things are materializing, Rob. They have become a menace. That's why what I'm planning to do should be done at once. . . Bee! Will you please not interrupt me!" It was the first time I had ever heard his tone turn sharp with her, and I realized then the strain he was under. "Rob, listen to me. Science has given me the power to do what I'm planning, but we won't discuss that now. Call this anything you like. What I want you to know is—there is another realm about us into which—under given conditions—our consciousness can penetrate. Call it the Unknown. The realm of Unthought Things. A material world? I've shown you, Rob, that nothing is substance if you go to the inside of it."

Dimly I was groping at a hundred will-o'-the-wisps, my mind trembling upon the verge of his meaning, my imagination winging into distant caverns of unthought things that hid in the elusive dark. Could this be science?

He was saying, "My mind cannot fathom such another realm, nor can yours. You think of land, water, trees, houses, people. Those are only words for what we think we see and feel. But there are beings—sentient beings—in this other state of consciousness we can now be sure. For Rob, they are coming out! Don't you understand? They have already come into the borderland between the consiousness of their realm and ours.

He would not let me interrupt him. "Wait, Rob! Let us say their realm is inferior. Or they have a lust for adventure—or a lust for something else—they are coming out nevertheless. A menace to us—that girl in Kansas is dead." He swept his hand in gesture at the apparition behind him. "That thing is watching me. As Bee says, it is on guard here. Because, Rob, I found a way of transmuting my identity out of this conscious realm of ours into that same borderland where these things we call ghosts are roaming. And they know it—and so they're on guard—watching me."

He paused for the space of a breath. Bee, white-faced, tremulous, turned to me. "Don't let him do it, Rob!"

"I must," he declared vehemently. "Rob, that's why we needed you here—to wait here with Bee. I'm going in there tonight—into the shadows, the borderland, whatever it is. These—nameless things are striving to come out—but I'm going to turn them back if I can!"

(*To be continued*)

LEAD TETRAETHYL FOR AUTOMOBILES

It will be remembered that some weeks ago that much excitement was occasioned by the idea that tetra-lead-ethyl, which was recommended as an addition to gasoline for use in automobiles, was liable to occasion cases of lead poisoning. A most extensive investigation was made under the auspices of the United States Public Health Service and two hundred and fifty-two subjects were exposed to different conditions, some to the lead ethyl conditions, others to ordinary conditions in garages, and it was found that no harm whatever resulted from the proposed addition to the gasoline. Curiously enough, lead poisoning symptoms were detected in garages in which none of the compound was used. This was supposed to be due to the presence of lead in the dust of the shops. The investigation is so thorough and so well checked by comparative tests that there is no doubt that the alarm was absolutely needless, at least in degree. The committee believes that the investigation should be continued but the conclusion so far as evolved is substantially that stated above.

The Telephone and the Farm

THERE was not a farmer in the world fifty years ago who could talk even to his nearest neighbor by telephone. Not one who could telephone to the doctor in case of sickness or accident. Not one who could telephone for the weather report or call the city for the latest quotations on his crops. Not one who could sell what he raised or buy what he needed by telephone. A neighborly chat over the wire was an impossibility for the farmer's wife or children.

In this country the telephone has transformed the life of the farm.

It has banished the loneliness which in the past so discouraged the rural population and drove many from the large and solitary areas of farms and ranches.

It is a farm hand who stays on the job and is ready to work twenty-four hours every day.

The telephone has become the farmer's watchman in times of emergency.

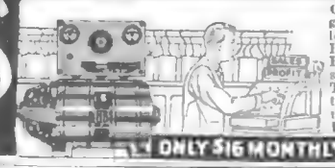
It outruns the fastest forest or prairie fires and warns of their approach. It has saved rural communities from untold loss of lives and property by giving ample notice of devastating floods. Three million telephones are now in service on the farms, ranches and plantations of the United States.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES

BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

$150 to $300 MONTHLY FROM ONE DAY BATTERY CHARGING

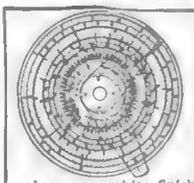


Charge batteries in 1/3 the time required by others and get the business. Latest method recommended by the U. S. Bureau of Standards. BIG YEAR ROUND PROFITS. Best paying business in automotive field. Requires no special experience, uses small space. 30 DAYS' FREE TRIAL at our risk under absolute money back guarantee. Write today for Bulletin X, giving full particulars.

HOBART BROS. CO., Box 84 TROY, OHIO

30 DAYS FREE TRIAL ON ABSOLUTE MONEY BACK GUARANTEE

ONLY $16 MONTHLY MORE THAN PAID BY INCREASED PROFITS



THE MIDGET SLIDE RULE instantly adds, subtracts, multiplies, divides, solves proportion, gives all roots and powers. Logarithms, Sines, Cosines, Tangents, Cotangents, Etc. Also gives decimal equivalents, lettered and numbered drill and tap sizes.

More than 110,000 sold, more than 2000 unsolicitated testimonials. The Engine-divided scales are on white finished aluminum and are grease and waterproof. Diameter 4". Price with Instruction Book, $1.50. Pocket Carrying Case, 50c extra, Cash or C. O. D. Catalogue free. Your money back if you are not satisfied

GILSON SLIDE RULE COMPANY, - NILES, MICH.

Electrical Course for men of ambition and limited time. Over 4000 men trained. Condensed course in Theoretical and Practical Electrical

Engineering including the closely related subjects of Mathematics and Mechanical Drawing taught by experts. Students construct motors, install wiring, test electrical machinery. Complete course

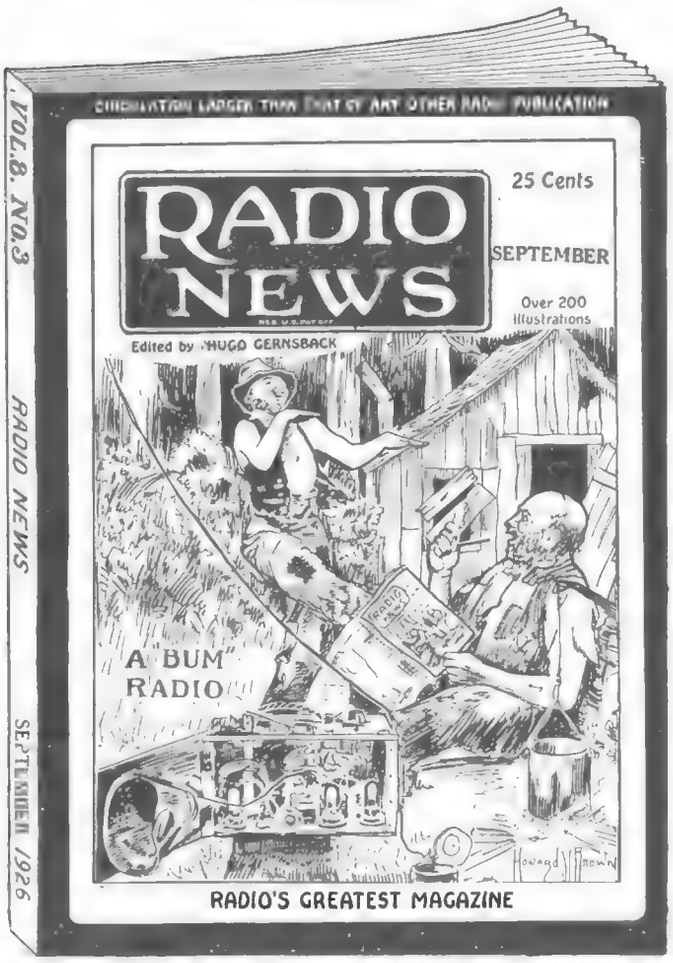
In One Year

Prepare for your ... interesting ... established ...

BLISS E...

119 Takoma ...

TELEVISION
Now An Accomplished Fact



READ, IN THE BIG SEPTEMBER ISSUE OF "RADIO NEWS" how it is now possible to see faces, events, etc., from a distance by Radio—Television will change our mode of living—Don't miss it!

Featured in SEPTEMBER "RADIO NEWS"

NOW ON ALL NEWSSTANDS

EXPERIMENTER PUBLISHING CO., Inc., 53 Park Place, New York, N.Y.

PHILADELPHIA
CHESTNUT AND 39th STREET
HOTEL PENNSYLVANIA

Fireproof—Unrestricted Parking—Garage

600 Rooms
500 Baths

Rooms with running water from $2.50 per day

Rooms with private Bath and Shower from $3.50 per day

FOOD AND SERVICE THE BEST

Near West Philadelphia Sta. Pennsylvania Railroad

OSCAR W. RICHARDS, Manager

WRNY Celebrates the First Birthday

By CHARLES D. ISAACSON

(*Continued from page 436*)

The Corporation Counsel of New York City, Arthur Hilly, poured forth some of his inimitable jokes. If you ever want a speaker to keep any crowd in stitches, engage Arthur Hilly.

I'm not going to attempt to repeat the list of folks who were there. But Dr. Miller, spokesman of the Protestant churches of the city; Dr. Goldstein of the orthodox synagogues; Dr. Landman of the Jewish Circle, and Dr. Reisner were the religious leaders. Arthur Guiterman, the literary, and Wolf Gilbert, the popular song leader, were also present.

And at 9 o'clock there came the demonstration of the Pianorad, the latest radio musical instrument, invented by Mr. Hugo Gernsback, Editor of RADIO NEWS. The Pianorad uses a keyboard like a piano, 25 vacuum tubes, and 25 loud speakers. The instrument gave beautiful flute-like tones that could be changed to the quality of an organ when desired. It is a development of the well-known Staccatone. It will be described in the October issue of RADIO NEWS.

THE EDISON MUSIC BOOK

The Edison Hour goes merrily along. Harry T. Burleigh, the negro singer, came back, and Beniamino Riccio, the operatic baritone, made his debut with the Edison Ensemble, while the Ukrainian Chorus gave a colorful program. Speaking of the Edison Hour reminds me to offer you their new wonderful book, "A World Tour of Music," which is very important, in that it tells you about the music of nine nations, their composers and important compositions, and is handsomely illustrated. Write me and I will see that you get a complimentary copy.

And talking of things complimentary, I am also empowered to offer a free pass to the wonderful amusement park, Starlight Park, to anyone who writes me here. To New York visitors this assures one solid evening's pleasure (bathing, opera, shoot the chutes, etc.) And one further offer: Madame Helena Rubinstein, famous beauty expert, who is now speaking over WRNY, is giving a free beauty reading to the ladies. Her fee is ordinarily a high one (she has been adviser to empresses, queens, leaders of society and the stage), but if you who read these words will write Madame Rubinstein, care of WRNY, and ask her for advice, she will be glad to help you.

NOVELTY PROGRAMS

I am particularly proud of the novelties, which have crowded WRNY's famous Friday night 10:15 hour. There was the epic of June Brides which apostrophised life, love and marriage. Then came the group which were transported from Hawaii and other points distant by Wally Gluck. Did you join us the night we had the "Campfire in the Woods," or did you travel to Czechoslovakia when we had a "Night in Prague?" The Czech Consul, Mr. Broz, was there to guide us on the last mentioned affair.

Far from the fields of novelties, came the heralded debate of Norman Thomas and Hugo Gernsback. The Socialist leader, former minister of the conservative Brick Presbyterian Church, a some-time candidate for the Governorship, attacked with sincerity the radio "interests." Mr. Gernsback defended, not the "interests," but the intentions of the radio industry and broadcast operators.

That was the night when Alice Brady appeared in the Edison prize play, "The Return of Mary Ellen," following Grant Mitchell and preceding Louise Closser Hale and Olive Wyndham.

Our Spiritualistic Investigations

By DUNNINGER

(*Continued from page* 406)

"Oh, Miss Mason has no set charges. She conducts her spiritual gatherings without charge but donations to carry on her wonderful work are gratefully received."

"What are the usual donations?" I asked, not to be outdone in generousness.

"Two dollars seems to be the amount that is ordinarily placed upon the plate," I was informed, "although some pay as high as five and ten dollars."

The little maid, who had left the reception room now reappeared, and told us that the medium would soon be with us.

More conversation followed among those present and notes and data were exchanged about the past, present and concerning future hopes and dreams that they hoped would some day materialize.

"I am going to ask about some copper stock I have had in my trunk for several years. I want to know if it will ever be of any value," remarked one believer. "That stock has never been of value and if it ever will be my name isn't Mary B. Maguire! But I have hopes, because it will be just as Madam Thelma says. I do have to raise money because my rooming house at—— 51st Street has a mortgage falling due soon."

I smiled to myself. Glancing at my friend I saw that he too was interested. Ha, ha, thought I, talk is the cheapest thing there is.

"My doctor says that in a week or two I shall be well again. My operation has been such a troublesome thing! exclaimed a bright young lady.

"What was the trouble?" asked another.

"Acute appendix," came the quick reply.

"Too bad . . ." said another, "my sister had the same trouble and died several weeks after she was pronounced cured."

What price glory thought I. And settled down to listen to the talk of these women.

Time seemed to drag. It usually does when one thinks of the marvels one is about to see! Several others compared notes and told of the things the medium had predicted as well as the things they were going to ask. A buzzer in the room, which we had not seen, buzzed merrily. As if knowing just what they were supposed to do the gathering filed into another room. We followed.

Seating ourselves in available straight-backed chairs all conversation ceased.

Enter the medium.

She was a tall, middle-aged woman, with large features and a firm jaw. Here was a woman who was able to cope with any emergency or circumstance.

In a firm, medium-pitched voice she began to speak.

"Any questions you care to ask my controls . . . for I am but a machine speaking the thoughts of the hovering spirits . . . must be concentrated upon. Through me they will communicate with you.

"We will open the séance with a few brief hymns. I will have my assistant distribute books among you."

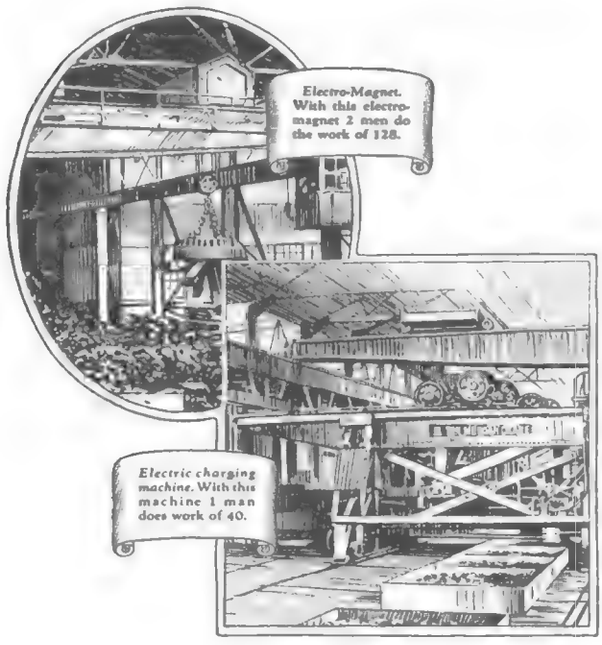
This was done.

"We all turned to the proper page and the song was rendered. Several more hymns were sung and the books collected and stacked upon the table in front of the medium.

More talk on the Great Beyond and spirit controls.

Gazing dreamily into space . . . the medium began to get seeming messages. At first she did not speak. Impressions must have been arriving.

One after the other, in quick succession, things were told the gathering. Messages


Electro-Magnet. With this electro-magnet 2 men do the work of 128.
Electric charging machine. With this machine 1 man does work of 40.

"Nobody lifts anything—*nobody sweats*"

said Sir Ernest Benn, an eminent British publicist, after a tour of America's industrial plants. He was deeply impressed with our vast investment in labor-saving machines.

American industry employs hundreds of ingenious machines to save men from grueling tasks. And, wherever electricity is broadly applied, the worker's day is shorter, he is well paid, and he accomplishes much.

There are in America industries so vast that each would need the man-power of half the nation if there were no machines such as these with their General Electric motors. In every step of manufacture, mining and forestry, through mill and factory, motors do the manual tasks with great saving of men and money.

GENERAL ELECTRIC

WORK FOR "UNCLE SAM"

$1700 to $3000 Year

RAILWAY MAIL CLERKS

MEN, WOMEN, 17 UP

Steady Work *No Layoffs* *Paid Vacations*

SHOULD MAIL COUPON IMMEDIATELY

COUPON ➤

FRANKLIN INSTITUTE
Dept. A178, Rochester, N. Y.
Sir: Rush to me without charge (1) Specimen Railway Postal Clerk and Mail Carrier Examination questions; (2) FREE 32 page book with list of U. S. Government positions obtainable and sample coaching lessons.

Name .....

Address .....

READ THE CLASSIFIED ADVERTISEMENTS ON PAGES 478-479. YOU'LL FIND MANY GOOD THINGS THERE

STAMFORD
IN THE CATSKILLS
The Land of Legend and Romance—
The Joy of Trampers, Golfers and Fishermen

REXMERE CLUB HOTEL
AND
CHURCHILL HALL
STAMFORD, N.Y.
TWO HOTELS WITH A SELECTED CLIENTELE
BOOKLET WITH PICTURES SENT FREE
H.H. MASE, MANAGING DIRECTOR.
WILLIAM J. LOWE, ASSOCIATE MANAGER
NOV. 1ST TO MAY 1ST
MIAMI, FLORIDA

DISCOVER NEW WORLDS

CONQUER DISTANCE! Lend wings to your eyes!—magnify your eyesight—discover new thrills—new joys—new worlds—new beauties of Heaven and Earth. Own a Genuine IMPORTED "Celestia" Telescope!

SEE BELTS OF JUPITER! RINGS OF SATURN! CRATERS OF MOON! SURFACE OF MARS!

Explore Them With This Big, Powerful 3½ Foot

35-POWER "CELESTIA" TELESCOPE

4 sections, heavy brass stock, beautifully polished, tarnish- and rust-proof; rich Morrocco leather body. Powerful "Celestia" lenses of brilliant illumination, great light-gathering power; magnificent 35-power! 58-Millimeter objective lenses. Length closed 12½ inches; extended 42½ inches (3½ ft.). Disappearing slide on eyepiece makes it Dust-proof, moisture-proof. Removable metal cap covers lenses.

FREE Trial for 10 Days

TELESCOPES are becoming increasingly popular because they are adapted for so many uses:—rifle or target practice; hunters; ranchmen; forest rangers; mariners; big game hunters; locating forest fir study of stars; general outdoor uses.

Preferred by Eminent Scientists

WE supply "Celestia" Telescopes to Explorers, Big Game Hunters, Globe Trotters, Universities, Scientific and Research Departments, etc. Delivered in sturdy case container. Regularly sells for $40. Our price (while limited importation lasts) $26.50

"Our Plan Is Different"

WE ASK for NO MONEY in advance. NOTHING on delivery. See, Try, Use, ENJOY "Celestia" Telescope for 10 DAYS' FREE TRIAL. If you're pleased, you may pay on BUDGET PLAN.

$6.00 MONTHLY

or, if you wish to paycash at end of 10 DAYS, deduct $1.75 and send Check or Money Order for $24.75 in FULL SETTLEMENT. Otherwise return them. Order NOW! Send NO Money! Pay Nothing on Delivery. $24.75

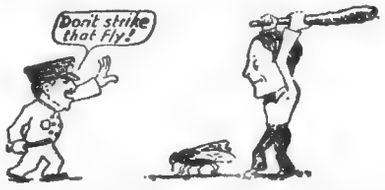
"2 Generations of Honorable Dealings"
SEAVER-WILLIAMS CO.
Importers, Exporters, National Mail Order House
365 WASHINGTON ST., BOSTON, MASS.
Sole Distributors of "Celestia" Telescopes

Gentlemen:—Send me the 35-Power "Celestia" Telescope for 10 Days' FREE Trial on the above plan.

NAME .....

ADDRESS .....

Tear out and mail this coupon NOW! If you wish to tell us something about yourself, it will be appreciated—simply write on separate slip of paper. THANK YOU! S.I. 9-26



VAC-U-SWAT

Picks up the flies with their filth and germs and disposes of them

VAC-U-SWAT Catches more Flies at one stroke than a swatter can strike.

Would you strike and smear a fly and his filth on your dining table or in your kitchen? Flies killed by poison fall in food or lodge and decay where they are a menace to health.

Vac-U-Swat defeats the fly by automatic air disturbance

VAC-U-SWAT is a patented mechanical achievement, absolutely new, useful, durable and sanitary.

VAC-U-SWAT appeals to everybody by its sanitary features and its clever operation, (attracts a crowd wherever shown.) Guaranteed as represented or your money refunded.

Tear out coupon below and mail today with regular retail price of $1.00 to our office nearest you.

VAC-U-SWAT COMPANY

Dept I, 4742 Fischer Ave., Detroit, Mich.
Dept. I, 510 Binz Building, Houston, Texas

Enclosed find $1.00 for which send postpaid one VAC-U-SWAT with plan for agents.

Name.....

Address.....

City..... State.....

Insure your copy reaching you each month. Subscribe to Science & Invention—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

began to come, the words issuing from behind clinched teeth. One woman was told about her recuperating from the appendix operation. Another about the copper bonds and the mortgage.

I was given a message from my dead sister. (I never had a sister). But I had spoken in the reception room of a sister and her name.

This is perhaps the key to the solution of the entire mystery.

The thing was out.

The elderly lady who had been there on several occasions was truly the spirit, but not a departed one. The astral force was that which was emphasized through the lips of the medium.

She of course gathered all the conversation she heard in the ante-room and what little more she needed was supplied by general conversation while we were waiting for the medium's entrance into the den of mysticism.

The elderly lady must, at one time, have been a stenographer of some sorts, inasmuch as she took down our conversation which seemed to be transmitted by the medium practically verbatim.

This information was written in short hand in the hymn book handed her, which the assistant took pains to keep on the top of the stack, when the books were later on collected.

This book containing the necessary information about those who had departed across the threshold . . . about my sister that never was . . . and the rest of the collected talk . . . was opened directly in front of the medium; an action apparently careless, but strictly necessary, as this so-called ghost woman must have also been a student of Isaac Pitman and could read stenographic notes very well

The information she imparted to me and likewise to my associate did not seem to upset our spirits to any marked degree, inasmuch as a short while later, we were seated in a restaurant enjoying the food products of the living, rather than feasting upon the psychic thoughts of the dead.

One fact, however, was quite apparent . . . my friend did not seem to be over anxious to discuss the happenings of the evening.

Later, comfortably ensconced in a cab, we lighted weeds and, looking at one another . . . we indulged in a hearty laugh.

(*No. 3 will appear in the next issue.*)

New Trickle Charger

Here is a new type trickle charger with tantalum-lead electrodes for your "A" battery which may be connected to the battery at all times. It is very compact and the output may be varied by introducing different size lamps in series with it in the power line. The normal charging rate is about .41 amp. for 4-volt batteries and .52 amp. for 6-volt batteries.

BIG SUMMER OFFER

$2 VALUE ..FOR.. $1

This is the biggest opportunity of the year.

To the readers of SCIENCE and INVENTION we have arranged to offer a big reduction in the famous Consrad Pattern's and E. I. Co. Books; millions of these have been bought by Radio Fans. They are recognized and sold by the best Radio stores and Newsdealers.

We offer any $2.00 worth of these books and patterns you may select for $1.

Think of it! $2 for $1. Just check $2 worth from the list below and send $1 with the coupon and we will mail you the materials at once.

LARGE ORDERS ACCEPTABLE IN THE SAME PROPORTION.

MAIL THIS COUPON NOW!

THE CONSRAD CO., Inc.,
64 Church St., New York, N. Y.

Gentlemen:—I enclose $1, please send me the items checked below. (Items checked not to exceed $2 worth.)

E. I. BOOKS, regular price 25c

- ☐ No. 1. Tips for the Radio Constructor.
- ☐ No. 2. How to Make Practical Radio Receivers.
- ☐ No. 3. Radio Questions Answered.
- ☐ No. 5. Loud Talkers and How to Build Them.
- ☐ No. 6. How to Tune Your Radio Set.
- ☐ No. 7. One Hundred Radio Hook-ups.
- ☐ No. 8. All About Radio Parts.
- ☐ No. 9. History and Operation of Vacuum Tubes.
- ☐ No. 10. The Neutrodyne and All About It.
- ☐ No. 11. How Radio is Received.
- ☐ No. 13. Reflex Radio Receivers.
- ☐ No. 14. The Super-Heterodyne, Theory and Construction.

CONSRAD PATTERNS, regular price 50c

- ☐ No. 2. How to Make a Two-Stage Amplifier
- ☐ No. 4. How to Make a Reinartz Receiver.
- ☐ No. 5. How to Make a Reflex Receiver.
- ☐ No. 6. How to Make a Cockaday Receiver.
- ☐ No. 9. How to Make the S.T. 100 Receiver.
- ☐ No. 11. How to Make a Five-Tube Cockaday Receiver.
- ☐ No. 12. How to Make a Portable Receiver.
- ☐ No. 13. How to Make a Harkness Receiver.
- ☐ No. 15. How to Make a Low Loss Receiver.
- ☐ No. 16. How to Make the Tropadyne Superadio.
- ☐ A. Radio Map of the U. S. on Cloth.
- ☐ B. 20 Radio Diagrams and Hook-ups.
- ☐ C. All About Aerials and Their Construction.
- ☐ D. Radio Amateurs' Practical Design Data.

NAME .....

ADDRESS .....

CITY, STATE .....

160 and 320 Volt "B" Eliminator

By A. P. PECK

(*Continued from page* 439)

photograph, however, and the wiring for it is also indicated in the diagram. A three-point switch serves to throw the voltmeter from one to another output circuit, so that each one can be measured separately. It must be realized that an extremely high resistance instrument has to be used in connection with such "B" eliminators, to obtain results of any accuracy at all.

Since we are dealing with high voltages it is necessary to have resistances of rather high load capacity to control the various outputs. There are several reliable resistances on the market today that are especially adapted to this work. One should be chosen that will not heat up under an ordinary load. A fixed resistor of this type or three well-made variable resistors and a fixed resistor can be used at the discretion of the builder.

In order to further simplify the wiring for the amateur, Mr. Brams employs a block type of filter condenser, wherein all the condensers are in one casing and handy terminals are provided. The various photographs will show clearly how such a procedure simplifies the wiring as compared with some of the original "B" eliminators using a maze of separate condensers. Although the condensers are used in block formation, they are shown separated in the diagram so their respective positions in the complete circuit can be more clearly seen.

An eliminator of this type will be a decided addition to any radio receiving set. With it a power amplifier using a UX-120 tube can be employed and thus great volume will be obtained. When less volume is desired the power amplifier can be cut out of the circuit and the low voltage output of the "B" eliminator employed. Of course, as can be seen in the photographs Mr. Brams "dolled up" his eliminator to a very great degree, but only because of pride in his workmanship.

SAYS GAS WILL OUST COAL

That gas as fuel will in a few years take the place of anthracite and all coals is the prediction of Dr. Julian C. Smallwood, Associate Professor of Mechanical Engineering at Johns Hopkins University.

"The days of anthracite are numbered," he said recently. "There is too little anthracite and it is too expensive. Many persons have told me that they have no intention of resuming its use after the interruption this winter. Under present conditions this means increased use of soft coal, with a consequently greater smoke nuisance."

Dr. Smallwood expressed himself as opposed to ordinances regulating the evil.

"The enforcement of such ordinances in other cities is not encouraging," he said. "They require the formation of still another bureau with a chief and a corps of investigators. We are already overburdened with them and their usefulness is, to say the least, problematical.

"In a few years gas will be far less expensive than at present, and gas, I believe, offers the most probable solution of the heat and smoke question. Oil is used in some cases, but there is not enough of it and it is impracticable. Coke is another serious possibility and awaits only improvements in methods of consumption.

"Railroads for some time to come will be obliged to use coal. The abatement of the smoke nuisance from railroads will come through electrification."

Magic

Learned Easily At Home

Dr. Harlan Tarbell
Master of Magic who has mystified magicians as well as laymen with his marvelous tricks.

Astonish Your Friends—

Gain that magnetic popularity that makes you the center of any crowd. Business and social success is assured the man who can perform mystifying tricks. You can earn big money either on the side or as a professional, as well as being the most popular person in your crowd. Why envy others' skill? You can learn Magic yourself, quick and easy.

Earn $250 to $1000 a Month

Even sleight-of-hand, generally supposed to require long practice, is NOW made simple to learn. For Dr. Harlan Tarbell, one of the really Great Magicians, has finally opened up the secrets of his profession in a completely illustrated course offered at a merely nominal cost. Through the wonderful Tarbell System you will be able to mystify and entertain your friends with simple tricks taught in your very first lesson. After that Dr. Harlan Tarbell takes you through the entire maze of sleight-of-hand, card tricks and elaborate stage divertisements. The apparently superhuman doings of the accomplished magician becomes as simple as ABC when you just know how.

Mail Coupon *for* Special Offer!

There is a tremendous demand for magic entertainment. Clubs, Lodges, Charity and Social affairs—all will pay high fees to the man who knows Magic. Dr. Harlan Tarbell really gets as high as $250 for a half hour's work right now. Opportunity everywhere to make money aside from your regular occupation. Salesmen find it a tremendous asset. Find out all about this unprecedented opportunity to learn Magic. The coupon brings full details without any obligation. Mail it TODAY.

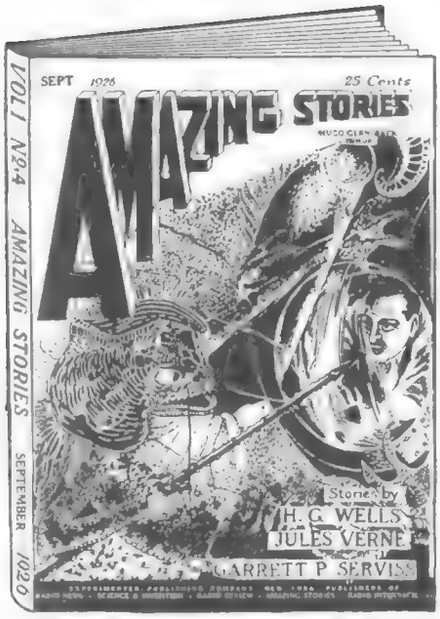
Tarbell System, Inc.
1926 Sunnyside Ave., Studio 14-26 Chicago

Tarbell System, Inc.
1926 Sunnyside Ave., Studio 14-26 Chicago
Tell me all about Dr. Tarbell's new and simple system by which I can learn the secrets of MAGIC. No obligation on my part.

Name.....

Address.....

..... *Age*.....



25c the copy

Other big features in September issue

THE PURCHASE OF THE NORTH POLE, by Jules Verne, in which some enterprising mathematicians and scientists attempt to bring the North Pole to a temperate zone—or bring the temperate zone to the North Pole. A stroke of lightning sets things flying in the mathematician's room and an error gets into the calculation. Of course, that upsets their plans considerably.

A COLUMBUS OF SPACE, by Garrett P. Serviss (2nd instalment) in which our adventurers continue their marvelous experiences with the Venustians on the light side of the planet Venus.

STATION X, by G. McLeod Winsor (Conclusion) in which the Venerian aids in a terrific battle against the Martians and Professor Rudge, at least, returns to tell the tale.

THE MOON HOAX, by Richard Adams Locke, is a classic scientifiction story containing excellent science along with some obvious mistakes, which were not detected even by a scientific audience. It is probably the greatest scientific hoax that was ever perpetrated upon a credulous public.

BLASPHEMERS' PLATEAU, by Alexander Snyder, wherein some eminent scientists successfully experiment with infinite secrets, until they become drunk with their power. Then another scientist arrives on a friendly visit. It is a powerful and gripping story which is sure to hold your interest.

Read

IN THE ABYSS

— By H. G. WELLS —

Take a trip with this world renowned author to an amazing city--5 miles under water!

A spherical steel shell fitted with a glass window and containing an intrepid explorer descends five miles to the floor of the ocean.

A number of human-like, terrible monsters surround the shell and carry it away—what happens to the explorer and his steel house will keep you in breathless suspense.

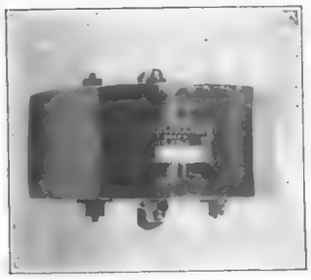
Incredible things occur, yet, as the author himself explains, there is today no knowledge to refute the amazing sights the explorer sees.

No more remarkable story was ever written—It takes you away from everyday, humdrum happenings, for a moment, to a new land of wonders.

Don't miss it—Featured in "Amazing Stories" for September.

BIG SEPTEMBER ISSUE OF "AMAZING STORIES" JUST OUT!

Sold on All Newsstands



Wonder Transformer of Radio

Madison-Moore transformers are absolutely precision, and for distance, selectivity, volume and quality have no equal.

Two-Types Equal Results

One for use with the 5 volt tubes, and one for the 3 volt tubes.

These Transformers were used in the set described in the August issue of SCIENCE & INVENTION

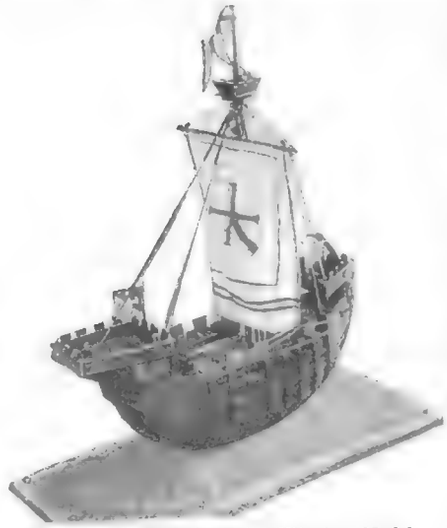
If your dealer does not handle these transformers, write us direct.

Madison-Moore Radio Corporation
2524 Federal Boulevard, Denver, Colorado

Madison-Moore

Model Department

(*Continued from page 422*)



Another View of the Prize Winning Model.

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.

2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.

3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.

4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.

5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.

6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the October contest must reach us on or before the 25th of July.

7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

LIGHTNING RODS

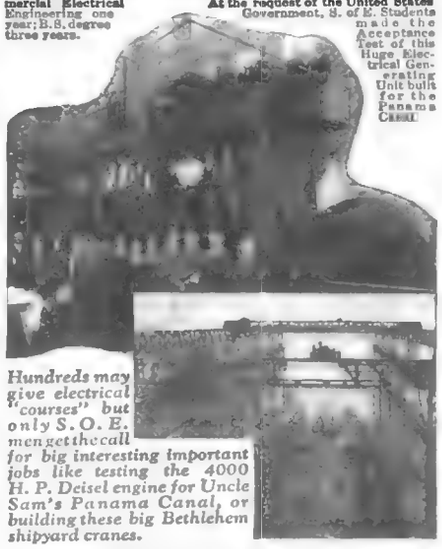
The Wisconsin Industrial Commission in urging property owners to install lightning rods stated that 500 people are killed and 1,200 injured annually by lightning in the United States and Canada. In Wisconsin alone the property loss caused by lightning in 1924 amounted to $923,210. The U. S. Bureau of Standards asserts that lightning rods reduce the fire hazard as much as 80% to 90% in the case of homes and by as much as 99% in the case of isolated farm barns. In spite of this simple and inexpensive means of protection, fires started by lightning in the United States in the year 1923 caused losses amounting to $10,922,669, according to the National Board of Fire Underwriters.

For Your Profession Choose ELECTRICITY

Four 90-day Practical Courses, commercial Electrical Engineering one year; B.S. degree three years.

New classes Sept. 1st & 27th

At the request of the United States Government, S. of E. Students made the Acceptance Test of this Huge Electrical Generating Unit built for the Panama Canal



Hundreds may give electrical "courses" but only S. O. E. men get the call for big interesting important jobs like testing the 4000 H. P. Deisel engine for Uncle Sam's Panama Canal, or building these big Bethlehem shipyard cranes.

PRACTICAL TRAINING!

We teach by scientific methods, under practical working conditions, all branches of Electrical Engineering. No matter what your age or education, there is a starting point for you at S. of E. Big concerns are pleading for trained men. We must get them.

YOU ARE a Graduated Electrician, Electrotechnician or Commercial Electrical Engineer after a few months of S. O. E. training. Practical Engineers teach you. Men like Prof. Ball, assistant to Dr. Steinmetz for years. We bring the finest engineering talent in Milwaukee and the middle-west right into the school. Men who know what and how you should do things to make big pay. Hundreds of thousands in equipment for you to work with.

$3200 AND UP AWAITS the S. O. E. man! Our graduates go to Commonwealth-Edison, Allis-Chalmers, Western Electric, Pawling and Harnischfeger, etc. Some of their biggest men are S. O. E. trained and on the lookout to help you when you come in.

MANY CAN EARN PART EXPENSES while learning. Our employment department places you. Low tuition. Splendid board and room reasonable. Daily broadcasting from school station WSOE. School orchestra. Fraternities.

ACT NOW FOR IMMEDIATE ENROLLMENT. A few choice part time jobs now open if you act. Our tuition fee is low. Refunded in full if you aren't satisfied. New book about S. O. E. now off the press and entirely FREE. If you want success in electricity send the coupon now.

SCHOOL of ENGINEERING of Milwaukee
FOUNDED 1905
Dept. 96 415 Marshall St., Milwaukee, Wis.

SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. 96, 415-17 Marshall St., Milwaukee, Wis.

Without obligating me in any way, please mail free 72-page illustrated book, "Electricity and the One Best Way to Learn It," and particulars regarding the course I have marked with an X.

....Commercial Electrical Eng.	....Armature Winding
....Elec. Eng., B. S. Deg. in 3 yrs.	....Light, Heat, Power Wiring, Testing
....Electrotechnics	
....Junior Electrical Eng.	....Practical Electricity
....Automotive Electricity	....Home Laboratory Service
....Radio Sales, Service and Broadcasting	

Name.....*Age*.....

Address.....

City.....*State*.....

Education.....

Will you be one of the 800,000 who will die this year of preventable disease?

OF the hundreds of thousands who die from respiratory diseases, bronchitis, pneumonia, kidney diseases, tuberculosis, influenza, and intestinal disorders, a large proportion would not have died if they had been able to recognize early symptoms and had known how to treat themselves.

Nature always warns of impending sickness. The occasional headache, that tired, exhausted feeling, loss of appetite, a casual cold and other slight disarrangements are Nature's warnings to you that your body isn't functioning properly or that you are not living and eating correctly.

You can rule your health just as surely as you can rule your actions. If you are not enjoying perfect health today it is because you haven't employed the method provided by Nature to keep you well. If you don't know what her requirements are, you are sure to blunder into some kind of sickness—perhaps fatal disease.

ENCYCLOPEDIA of PHYSICAL CULTURE
New 6th Edition ~ Completely Revised

EVERY year more than ten thousand people die of bronchitis, sixty-four thousand die of pneumonia, seventy-five thousand die of kidney trouble, fifty thousand die of respiratory disease, one hundred and six thousand die of tuberculosis, approximately eighty-five thousand die of influenza, and more than ten thousand die of intestinal trouble.

Barring accidents and suicides, only a small percentage of these thousands should die.

It is a fact that only about one person out of three enjoys good health. And those who are physically a little "off" right now will more than likely be the ones to succumb to preventable diseases this year. And they are the ones who should not die.

Nature is constantly warning you of impending sickness. Seemingly trivial symptoms tell of serious trouble taking root in your body. And yet, ninety-nine people out of every hundred will absolutely ignore these danger signals. As long as they are not flat on their backs, they will fool themselves into believing that they are all right.

Nature is merciless. If you do not understand her laws and her methods of preventing and curing sickness, you suffer. She knows no excuse—she accepts no apologies.

The Average Person Pays Thousands of Dollars in Doctor's Bills

Those who do not know Nature's methods of preventing and curing sickness are ill an average of 21½ days each year. In fact, it is estimated that the average person in a lifetime spends $4,100 on doctor and hospital bills, loss of time from business, medicine and other expenses due to illness. Thousands of people are living half-powered lives because they are ignorant of the laws of Nature. Many of these people will fill an early grave, when they might easily have lived to enjoy a ripe old age.

What would it be worth to you to be able to instantly identify in its earliest stages any sickness or disease that might overtake you or any member of your family? To enjoy perfect health, almost complete freedom from sickness, doctor and hospital bills, and no days of suffering and worry, or salary lost through sickness?

How to—

possess exhilarating health every day in the year
know your own body
eat for health
diet for the cure of disease
know the art of food preparation
build a powerful physique
correct physical imperfections
become a physical director
avoid unhappy marriages
avoid disease
fast as a curative measure
cure by hydropathy (heal by the use of water)
apply all methods of drugless healing
give first aid in emergencies
apply home treatment for disease
recognize diseases by manifestations
build nervous energy
treat the common form of disease
understand the process of reproduction
benefit by laws of sex and marriage
treat diseases of women
diagnose diseases
have healthy and vigorous children
treat female disorders
treat male disorders
obtain virility and manhood
care for the complexion
manicure; care for the hair and feet
cultivate the mind

These are only a few of the matters explained in the Encyclopedia.

The Encyclopedia of Physical Culture

(6th Edition—Greater Than Ever Before)

This marvelous 5-volume work gives you the information you need to build up rugged strength, health and vitality. It is for every member of the family—it covers every phase of strength and body building for adults, children and babies. It gives invaluable information on fasting, dieting and exercise. A thorough and extensive treatment is given of the laws of sex, the attainment of virile manhood and womanhood, and happy, successful parenthood, together with details for diagnosis and treatment of all sexual diseases. Handsomely illustrated charts on anatomy and physiology are scattered throughout the book.

It is neither dull nor technical, but is simple, comprehensive and complete in every sense. It is the crowning effort of Bernarr Macfadden's rich, full experience in the science of health and physical culture. He has had more than thirty years' experience in guiding thousands of physical wrecks to glorious health and vigor. Out of that experience he built his Encyclopedia of Physical Culture.

Five big editions of this popular work have been exhausted. And now the sixth edition—greatest of all—has just come off the press. This edition has been completely revised at great expense. Scores of new illustrations have been inserted. The binding has been changed to a beautiful all Fabrikoid, more durable than leather. Altogether it is the finest edition of the Encyclopedia ever issued.

10 Days' Free Examination of Entire Set—No Money Needed

This is the most liberal offer we have ever made on the Encyclopedia—10 days' examination of the entire set at no expense to you. There is no money needed—no deposit to pay. Just fill in the coupon and we will send the five volumes to you, all shipping charges prepaid, for your inspection.

Take ten days to examine the set. Then, if you decide to purchase, send us only $2.00 as your first payment. Additional payments may be made at the rate of only $3.00 a month until the total cost of $35.00 has been paid.

If you care to pay cash you may do so by sending us only $31.50. This represents a 10 per cent discount.

If you purchase the set we will include with it special membership in our Advice Department, maintained and equipped to serve you. This service alone may be worth many times the cost of the books.

Remember, no money now, and no obligation to purchase. You simply agree to return the books at the end of ten days in case you decide not to keep them.

MACFADDEN PUBLICATIONS, Inc.
Dept. SC-9 1926 Broadway, New York City, N. Y.

MACFADDEN PUBLICATIONS, Inc. **SPECIAL**
Dept. SC-9, Macfadden Building,
1926 Broadway, New York City.

Send me on 10 days' inspection the five volumes of the Encyclopedia of Physical Culture. If I find the set satisfactory I will either send $2.00 in ten days and $3.00 a month until $35.00 has been paid, or $31.50 cash. If I decide not to keep the books I will return them in 10 days postpaid.

Foreign orders—cash in advance.

Name .....

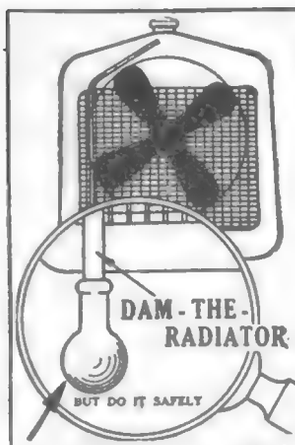
Occupation .....

Residence .....

Employed at .....

Business Address .....

I understand that this price includes Special Membership in your Advice Department.



For 15 Cents

Keep your radiator full all season. Prevents loss of water and alcohol by sealing overflow tube safely. Specially prepared resilient rubber. From your dealer or direct.

Big Proposition for Dealers

JO BERGE CO., 233 Br'dw'y, N. Y.

Play the HAWAIIAN GUITAR Just as the Natives Do

FREE when you enroll $15 HAWAIIAN GUITAR and Case

Only 4 Motions used in playing this fascinating instrument. Our native Hawaiian instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

Play in Half Hour — After you get the four easy motions you play harmonious chords with very little practice. No previous musical knowledge necessary.

Easy Lessons — Even if you don't know one note from another, the 52 printed lessons and the clear pictures make it easy to learn quickly. Pay as you play.

Free Guitar and Outfit in Genuine Seal Grain Fabrikoid Case as soon as you enroll. Nothing to buy—everything furnished. No delay.

Write at Once — You'll never be lonesome with this beautiful Hawaiian Guitar. Write for Special Offer and easy terms. A postcard will do. ACT!

FIRST HAWAIIAN CONSERVATORY of MUSIC, Inc.
9th Floor, Woolworth Bldg., Dept.—— 140 New York, N. Y.
Approved as a Correspondence School Under the Laws of the State of New York

Absolutely Guaranteed

WADE BENCH LATHE

For Repair Shops, Amateur Mechanics, Model Makers, Inventors who want a real, *accurate* machine tool at a price within easy reach. *A complete shop in itself.* Capacity 4 in. diameter x 12 in. length. Handles metal, wood, and other materials. Turning -- facing -- boring -- drilling--winding--thread cutting. The "Wade" is a bargain at several times the price. Guaranteed a high degree of accuracy, quality of materials, workmanship and finish.

The slideresf has travel entire length of bed. Leadscrew inside bed. Hollow spindle.

No. 1 Lathe, plain headstock - - $28.00
No. 2 Lathe, back-geared - - - 58.00

Either lathe with 18 in. length between centers, $7.00 extra. Complete line of accessories. By all means write for this free book.

THE GEROLD COMPANY
Dept. S-16 120 Liberty St., New York

Gas Blow Torch and Solder Iron Heater

Connects to any gas jet or gas connection. No air attachment necessary. Heats solder iron in less than a minute. For home use, repair shops, laboratories, manufacturing plants, and foundries. A wonder for the mechanic's work bench.

A Blast 8" long, 1" in diameter—Intense Heat.

Postpaid $1.00; Canada $1.40
TRI-UNE COMPANY, Dept. 804
215 S. 15th Avenue - - Maywood, Ill.

Begin Today—Write for My FREE BOOK. I can make a good penman of you at home during spare time. Write for my FREE BOOK, "How To Become a Good Penman." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. Write today for book.

F. W. TAMBLYN, 424 Ridge Bldg., Kansas City, U.S.A.

BE AN OFFICER
IN THE U. S. COAST GUARD
$1,700 UP TO $7,500 YEARLY

$780 yearly at the U. S. Academy while training. You rank Ensign to Captain in service. Age requirements 18 to 24. Write Dept. B, for information.

COAST GUARD PREPARATORY SCHOOL
4000 Ga. Ave. N.W. Washington, D.C.

Insure your copy reaching you each month. Subscribe to SCIENCE & INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

Odd and Unusual Patents

(*Continued from page* 405)

Any cyclist who has had his heels nipped by a dog will appreciate the value of the "dog chaser" patented by a young lady. This invention proposes to fix two perforated boxes to the forks of the bicycle. The boxes were to be filled with snuff, pepper, or other pulverized material calculated to repel vicious canines who annoy cyclists, and were connected with tubes to a bulb fastened to the handlebars. The bulb need only be compressed and the pepper is sprayed upon the dog. The inventor claimed that the dog ceased to annoy after having a pepper spray.

There is no disputing the statement that a vast amount of thought and consideration has been given to the subject of awaking from sleep. The patent records show that at least three men wanted to rid mankind of its most distressing foible—oversleeping. The first secured a patent on a combined alarm clock and bedstead. The inventor provides for "the dropping of a bolt, as the hour hand of the alarm clock reaches the appointed hour, lets loose a set of bars which holds up the mattress which in turn swings upon central pivots dropping the sleeper upon the floor." The second covers an alarm clock connected with a container and a tube. The tube has a perforated end to be fastened about the neck of the sleeper. Before retiring the user fills the container with water, and at the hour set a spring actuated by the clock releases the water from the container into the tube and the sleeper is given a cold shower. The inventor speaks of this device as "an easy awakener." The third patent is called "an alarm and waking bed." This contraption consists of a clock which, upon striking the hour set, releases a bar and the head portion of the bed collapses, thereby giving the upper part of the sleeper's body a severe jolt.

The realm of courtesy is brought into contact with the field of invention by a gentleman from Seattle who patented a self-tipping hat. This ingenious man constructed a hat which would tip itself without the aid of the hands. The hat contained a curious mechanism which was held in a case clamped to the head of the wearer. In the words of the inventor this remarkable headpiece "automatically effects polite salutations by elevation and rotation of the hat on the head of the saluting party when said person bows to the person or persons saluted."

A patent which is quaintly reminiscent of Percy, the famous mechanical man of the comic sheets, was granted on the invention of a man named Praul, covering a steam tractor engine which was propelled by a very unusual means. Instead of having wheels at the rear of the carriage, the inventor provided two pair of vibrating levers or walking legs which operated forward and backward in an elliptical movement, one metal foot being placed forward and then drawn backward thereby pushing the engine forward. The inventor described the legs of his contraption as "moving like the hind legs of a cow." This device was intended for farm use, being especially adapted for running over rough ground.

In the early days of railroading, experiments were made on many unusual devices before the locomotive engine successfully solved the problem which confronted the railway builders. An early nineteenth century patent covers a car driven by means of a horse on a treadmill inside the car, which, by means of connection with a set of gears, drove the wheels forward. Actual experiment proved this odd means of propulsion unsatisfactory for railroad use. When the

(*Continued on page* 471)

Jobs for Home Trained Men in ELECTRICITY

$65 a WEEK AND UP!
Get into a field that's not crowded. Draw real pay! If you can be reached by mail, we can train you for success in electricity.
A few happy hours a week in work with a "kick" in it.

ELECTRICAL EXPERTS are needed now as never before. Even electrical trades are making record money. But men with expert electrical training such as we give you, are earning $3250 a year and up by the thousands. And the big modern electrical "boom" has only started. Jobs by the hundreds are opening up. Electrical refrigeration, power plants, battery stations. A profitable business for yourself. The kind of job you've always wanted. Where you do the bossing and let the other fellow do the $25 a week hard work.

Charles P. Steinmetz, A.M., Ph.D., "Electric wizard" of General Electric was for the last six years of his life on the Advisory Board of School of Engineering.

FREE EMPLOYMENT SERVICE and it doesn't cost you a penny. Thousands of firms look to us for men. General Electric, Harnischfeger Corp'n., Commonwealth Edison are only a few places where S. of E. men get rapid advancement. Hundreds have been helped by us in selecting the right place to go into business for themselves. Coupon brings you big FREE book with all details.

WHATEVER YOUR AGE OR EXPERIENCE we can train you for success and big pay in electrical work. Hundreds of our most successful students are not even high school graduates. You don't need to know a single fact about electricity. In 22 years of teaching men to be a success we have found just what you should know and how to teach it to you to insure the quickest success when you go on the job. Earn $65 a week and up. It's "in the cards" for you if you act and send the coupon.

IN BUSINESS FOR YOURSELF

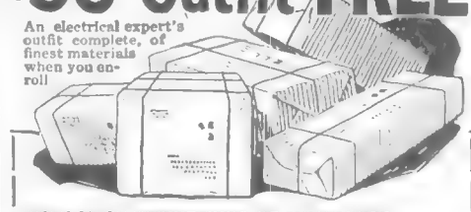
Hundreds of S. of E. men locate in business for themselves. With our help it's easy to get started.

SATISFACTION GUARANTEED OR MONEY BACK is the way we stand behind S. of E. training. We can afford to because S. of E. men make good. They have the prestige for some of the biggest electrical men in America are S. of E. men. A signed money-back guarantee bond is yours the minute you enroll. Your training must satisfy *you* or every penny is returned.

GET STARTED—MAIL THE COUPON NOW. A big 72 page book in colors and illustrated with pictures of successful S. of E. men and their jobs will be rushed postpaid. Full details on S. of E. home training and the big opportunities that await you. **Mail Coupon Right Now.**

$50 Outfit FREE

An electrical expert's outfit complete, of finest materials when you enroll



SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. 56, Box 572, Milwaukee, Wisconsin

Send me FREE and postpaid without obligation your big 72-page book telling about S. of E. training and opportunities for me in electrical work. Also details of your employment service and money back guaranty.

Name.....

Address.....

City..... State.....

Ropin' the World with Action!

People the world over thrill to the splendid stories found monthly in
TRIPLE-X MAGAZINE

SEPT. issue on sale NOW!

Be Sure to Read this Big Western Novel

Warriors of the Platte

By George W. Barrington

An epic of the Nebraska cattle country; nesters, cattle rustlers, cowboys and gunmen ride through this fast moving tale of the old West—Complete in the September issue.

Bad Men's Luck

By H. Bedford-Jones

A tale of mysterious "Eye of Osiris" and the fate it brought to those who coveted it—a smashing tale of strange events in Arizona.

Back 'o Beyond

A long novelette of the Western mountains, a gold rush, and the deeds of brave men, by noted writer, Frank H. Shaw. Two tenderfoots, boy and girl, show two old timers youth doesn't lack courage.

ALSO—

A brilliant boxing yarn by Herbert L. McNary, noted sport writer. Here's a boxing yarn that is different—an unusual distinction, since most boxing yarns are twice-told tales. You'll get a thrill out of this one. There are short Western stories by Jack Smalley, Floyd T. Wood, H. L. McNary, and W. Carlton Davis, and others. A north woods yarn by Edwin Samson, "Silver Skins."

Also—The Conclusion of Arch Jordan's Western Novel,

North of the Border

When "Judge Colt" Ruled

By William Corcoran

The blaze of forty-fours, and the deep boom of heavy rifles join in a battle song that will stir the dullest pulse.

Fawcett Publications, Inc., Robbinsdale, Minn. (S.F.)

Enclosed find $1.00 (in check or money order) for which please enter my name as a subscriber to your special five months' offer. Or enclosed find 25c for which please send me one copy of the September issue of *Triple-X*.

Name _____

Address _____

City _____ *State* _____

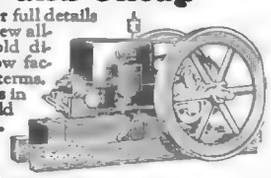
The Most Modern Up-to-Date Engine—the WITTE

$5 Down Buys Any Standard WITTE Engine—The One-Profit Engine—From 1½ to 7 H-P.

NO INTEREST CHARGES

The Standard WITTE engine which has revolutionized farm power, can do your jobs cheaper and in a fraction of the time. This new WITTE delivers super-power, steady and reliable at any speed, on either kerosene, gasoline, gas-oil, distillate or gas. Trouble-proof. All sizes, 1½ to 30 H-P. Completely equipped with WICO Magneto, square, protected tank, die-cast removable bearings, speed and power regulator and throttling governor.

Makes All Power Work Easy and Cheap



Write me today for full details of this amazing new all-purpose engine sold direct-to-you at a low factory price and easy terms. Thousands of users in all parts of the world say it's "BEST". Write me personally for my bignew catalog and full details, absolutely FREE and no obligation. Or, if interested, ask about our Log and Tree Saws, 3-in-1 Saw Rigs or Pump outfits. ED. H. WITTE, Pres.

WITTE ENGINE WORKS

3753 Witte Bldg., KANSAS CITY, MO.
3753 Empire Bldg., PITTSBURGH, PA.
3753 Witte Bldg., SAN FRANCISCO, CAL.

Quick shipments also made from nearest of these warehouses: Minneapolis, Minn., Atlanta, Ga., Trenton, N. J., Richmond, Va., Tampa, Fla., New Orleans, La., Dallas, Tex., Laredo, Tex., Denver, Colo., Billings, Mont., New York, N. Y., Albany, N. Y., Bangor, Me., Portland, Ore., and Los Angeles, Calif.

Stop Using a Truss

Reduced Fac-Simile Gold Medal

Reduced Fac-Simile Grand Prix

STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemico applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

Plapao Co., 924 Stuart Bldg., St. Louis Mo.

Name .....

Address .....

Return mail will bring Free Trial Plapao

TELESCOPES

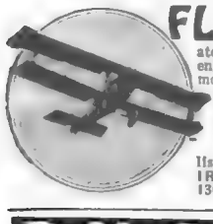
Amateur astronomers, here is an opportunity to own a good telescope.

PRICES $12.00 AND UP

Send 10 cents for further information

ERNEST W. BLANDIN

1207 Columbia Terrace Peoria, Ill.



FLY Young man, learn aviation. Build this classy plane and learn to construct and operate aircraft. Use your motorcycle engine or our "Meteor" 20 h.p. motor. We furnish parts very reasonable to build this wonderful little "Meteorplane" the World's first successful Light Plane. Send $3.50 for complete set of blue prints and parts price list of this latest Model M-T-2.

IRWIN AIRCRAFT COMPANY
130-0-Street, Sacramento Calif.

Be My Candy Agent

Make big money. Sell chocolate bars, fruit drops, nut clusters, chewing gum and popular packages, 50 kinds. All fast sellers. I make the best. Season just starting. Free samples. Need agent at once. So answer this ad NOW.

MILTON GORDON, 1416 Vine St., Cincinnati, Dept. 1230

Insure your copy reaching you each month. Subscribe to SCIENCE & INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

Odd and Unusual Patents

(*Continued from page 469*)

feelings of the horse are considered, it is fortunate that the treadmill-car was not a success.

Ingenuity knows no bounds or rules. Some clever chap secured a patent on a raincoat with a gutter and a spout. The lower hem of the coat is turned up to form a gutter and is inclined so that the water will run to one side where a tubular spout several inches long shoots the water away from the wearer, the idea being, of course, to keep the legs dry.

Snoring is still a great menace to society although in 1872 a humorous patent issued on an Anti-Snoring Device. The patentee alleged that "a person cannot snore while lying on his side," and to prevent lying any other way he provides us with "an arch of hard material secured between the back of the shoulders by means of straps about the waist and neck, thereby preventing the person from sleeping on the back." Snoring is thus easily eliminated by a removal of the cause. We also find among the patents a guillotine for decapitating poultry.

(*To be continued next month.*)

Book Review

FREEHAND DRAFTING, by Anthony E. Zipprich. Hard covers, 6" x 9", illustrated, 131 pages. Published by D. Van Nostrand Co., New York City. $1.60.

This is a very suggestive book. It tells about drawing without a ruler, tee square or triangle, and teaches or endeavors to teach dependence on the human hand. The book work is so very practical with so many illustrations giving examples of free hand practice, that it is most interesting. The position of the hand for drawing straight lines and curves is given in such detail that the work and manipulation of a left handed draftsman is considered. All kinds of elementary shapes and lines open the book, and then we come to geometrical definitions with numerous illustrations in perspective of solids. The idea is of course that free-hand work leads to the production of perspective views, while the servant of the tee square and triangle always tries to do everything in the boldest projection. One chapter is given to isometric sketching, which may be termed in a sense, the lazy man's perspective. It is, however, perspective with the observer so far away that the vanishing point ceases to exist. No better practice could be found for one who has occasion to make these quick sketches than to follow right through the book and copy the many very characteristics and instructive examples given.

FARM ENGINEERING, by Byron Burnett Robb, M.S.A., and Frederick Gardner Behrends, B.S. Hard covers, 5¼" x 8¼", illustrated, 454 pages. Published by John Wiley & Sons, Inc., New York City. $2.50.

The old house of John Wiley & Sons long known to the scientific world are issuing a series of books called the "Wiley Farm Series." They are edited by Professor A. K. Getman, Supervisor of Agricultural Education at the University of the State of New York. This book is the first of the series and the only one so far published. About everything imaginable about the farm is included, such as harness repairing, (Henry Ford has not yet driven away all the horses), soldering, rope work and belt lacing. These we may place at the foot. So fully is all this given and in such detail, and with such numerous illustrations, that it will interest anyone, even if it were only on account of the wide application of much that is described. A section on knots is such as to give points to almost anyone, and even the yachtsman will find instruction here. Then as we go on the installation of a power plant, leveling up for foundations, the engineering of drainage and the installation of concrete work, and coming into the house the subject of plumbing is very fully given. The number of illustrations is in excess of the pages, and a very good index is given. We warmly commend the work to our readers.

(*Continued on page 474*)

SHOW CARD LETTERING *Learn at Home*

HERE is the very course you need if you want to get a good paying position as a Show Card Letterer or Sign Letterer, or have a business of your own. This course is complete and practical and especially arranged to meet the needs of the student who studies at home. It was written by E. L. Koller, Principal of the School of Art of the International Correspondence Schools, member of the American Federation of Arts, and The National Society of Craftsmen.

Mr. Koller has had twenty years' teaching experience, and his success in helping other men and women is an indication of what he can do for you.

H. L. Wood, a clerk, made more than $700 "on the side" before he had completed his course and also won $125 in prizes. Harry William Lord writes that he has more than doubled his salary as a result of studying this I. C. S. course in spare time. William Whitman, a former wagon builder, now has a sign painting business of his own and is earning *nearly three times* as much as he did before enrolling with the International Correspondence Schools.

There is no doubt that Show Card Lettering and Sign Lettering offer a real opportunity to ambitious men and women. Just mark and mail the coupon and we'll gladly send you a booklet telling all about the I. C. S. course in Show Card Lettering, or any other subject in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6162-E, Scranton, Penna.

The oldest and largest correspondence schools in the world

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

☐ SHOW CARD LETTERING

☐ ILLUSTRATING	☐ CARTOONING
☐ Business Management	☐ Advertising
☐ Business Law	☐ Better Letters
☐ Banking and Banking Law	☐ Stenography and Typing
☐ Accountancy (including C.P.A.)	☐ Business English
☐ Nicholson Cost Accounting	☐ Civil Service
☐ Bookkeeping	☐ Railway Mail Clerk
☐ Private Secretary	☐ Common School Subjects
☐ Salesmanship	☐ High School Subjects

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Surveying and Mapping
☐ Electric Lighting	☐ Architect
☐ Mechanical Engineer	☐ Architect's Blueprints
☐ Mechanical Draftsman	☐ Contractor and Builder
☐ Machine Shop Practice	☐ Architectural Draftsman
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobiles
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....

Street Address.....

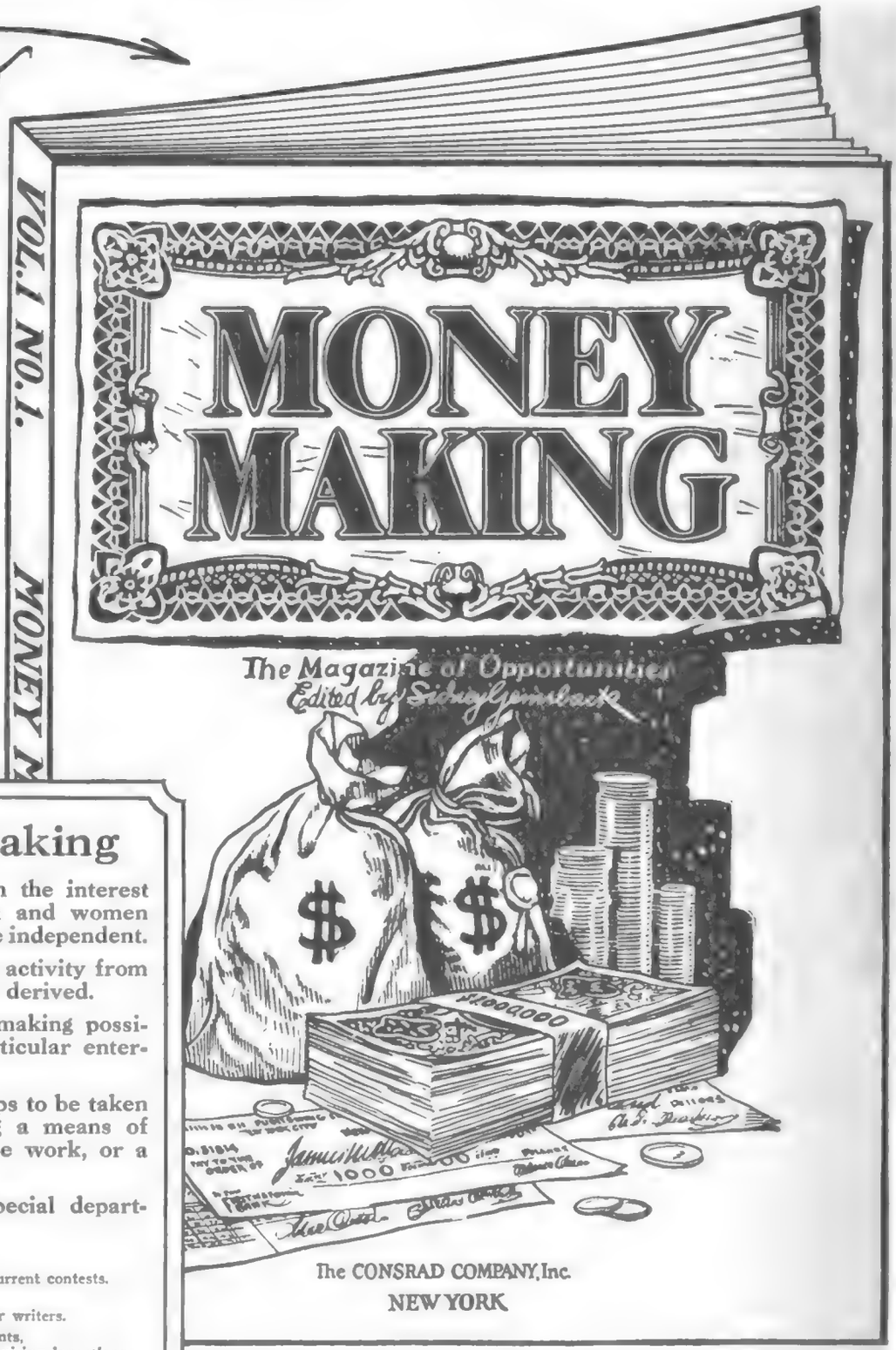
City.....State.....

1000 NEEDED INVENTIONS!

Here is the most remarkable book ever offered to inventors. One Thousand needed inventions listed and described. Arranged as follows: General Problems; Automotive; Mechanical; Electrical; Chemical; Radio; Marine. Separate chapter on the Ten Most Needed Inventions. This book may give you one idea that can win you a fortune. Nothing else like it has ever been published. Compiled at enormous expense. Edited by Raymond Francis Yates, formerly Managing Editor of a leading scientific magazine. Over 100 pages, durably bound. Send no money. Pay postman only $1.00 plus postage on arrival. Money back after 10 days' examination if desired. Limited edition. Write NOW.

BUREAU OF INVENTIVE SCIENCE
DEPT. 79Y ROCHESTER, NEW YORK

This New Magazine Will Increase Your Income!



Money Making

Published monthly in the interest of ambitious men and women who want to become independent.

Covers every field of activity from which profit can be derived.

Explains the money-making possibilities in each particular enterprise.

Discusses definite steps to be taken by people adopting a means of livelihood, spare-time work, or a second income.

Has the following special departments:

Prize Contest Record,
a classified directory of current contests.

The Literary Market,
a record of periodicals for writers.

Opportunities in New Patents,
illustrating the latest promising inventions.

Agents' Opportunities,
describing attractive items for salesmen.

Money-Making Formulas,
with directions for preparing specialties.

Cash Prizes for Money-Making Ideas,
announcing the rules for our prize awards.

Publishes feature articles by recognized authorities in many fields, as, for instance, real estate, selling, writing, manufacturing, investments, speculation, farming, the mail order business, decorating, candy making, needlecraft, photography, mechanics, chemistry, window trimming and many others.

Subscription Price, $2.50 the Year

SECURE A SECOND INCOME

Be independent in business—There are opportunities for big profits everywhere

MONEY MAKING is devoted to specific means and methods of increasing incomes. Hundreds of ways of making money in spare-time work are explained every month.
Read MONEY MAKING and learn how.

25c ON ALL NEWSSTANDS

Ask your newsdealer for a copy to-day.

Published and Distributed by
The CONSRAD Company, Inc., 64 Church St., New York, N.Y.

Kenilworth Inn

Asheville N. C.

Comfortable rooms - best sports excellent food
REASONABLE RATES
Write for Booklet
ROSCOE A. MARVEL *Manager*

The HOME of HOSPITALITY
In The Land of The Sky

FOR CLEAR, QUIET "B" POWER

$2.75

RADIO
Storage "B" Battery

12 Cells
24 Volts *Lasts Indefinitely—Pays for Itself*

Economy and performance unheard of before. Recharged at a negligible cost. Delivers unfailing power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with *Solid Rubber Case*, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. **Extra offer:** 4 batteries in series (96 volts), $10.50. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 83 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp., $11.25; 140 Amp., $13.25; 140 Amp., $14.00. All equipped with Solid Rubber Case.

World STORAGE BATTERIES

Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, WSBC, Chicago. Watch for announcements.

KDKA - WEAF - WGN - WJS - KHJ - KGO - KFAF - WJY - KOP

Be Popular Play Jazz—

It sets them going. Young folks are enamored by those tantalizing tunes. Be the Jazz King with your

BUESCHER True Tone

SAXOPHONE

Teach yourself, 3 free lessons give you quick easy start. Try any instrument in your own home 6 days free. See what you can do. Easy terms if you decide to buy. Send now for beautiful free literature. A postal brings details.

Buescher Band Instrument Co. (6)
1539 Buescher Block Elkhart, Indiana

MODELMAKER

A new magazine for all interested in making

WORKING MODELS

Send 10 cents for Sample Copy

MODELMAKER, 120 S. Liberty St., New York

Home Mechanics

By WILLIAM BUTTERFIELD

(*Continued from page* 411)

a good idea of their construction may be had. The three large ones are 30 inches long, 13¾ inches wide and 6⅜ inches deep. The four smaller 9 inches long, 6¾ inches wide and 4 inches deep.

An ogee molding 1 inch wide and 1½ inches high is used at the bottom of the desk as shown. The back legs are formed by a part of each side piece, the front legs are of composition in the style of claw feet. They are screwed to the bottom frame.

The brass locks, hinges, glass knobs and sliding drop lid supports can be had at any furniture maker's supply house. The composition legs can be obtained there also.

The upper section or bookcase part of the desk is assembled first with two sides, each is 41 inches long, 9 inches wide and ¾ inch thick. A top 1 inch thick, 33 inches long and 10 inches wide is put on just as the top of the lower section is mortised and tenoned. Both tops are the same size and thickness. A molding is cut on three sides of these two tops. It may be "stuck" on by machinery. The back is ⅛-inch ply-wood and is 41 inches long and 29½ inches wide. A ½-inch ply-wood bottom is used with mortise and tenon ends; it is 30½ inches long, including the tenons, and 8¾ inches wide.

The door frame for this section is formed of the sides, bottom and a ¾-inch square maple cross-piece at the top (as shown). A ½-inch ply-wood door stop is made using two ½-inch square uprights and a cross-piece 1¼ inches wide and ½ inch thick (see illustration). Four ½-inch square ply-wood cleats are used to support the shelves. The shelves are maple and 29½ inches long, 7½ inches wide and ¾ inch thick.

Before working on the door, it may be best to study the construction of a door and window sash by observing these two articles in their finished state. The outer upright pieces are called stiles, the cross-pieces are called rails and the thin pieces, forming the wooden divisions to the glass, are called bars. The stiles are grooved at the joints and the rails have tongues to fit the grooves. When glass is used, the opening made by joining these pieces together is rabbeted or cut out for the glass. The bars are made to fit into the rabbeted portion, and into their own rabbeted parts (see illustrations). They are held in the door part and to each other by mortise and tenon joints. For furniture all joints are glued.

The door is ¾ inch thick, 29½ inches wide and 40¼ inches long. The bars are ¾ inch square, the stiles 5 inches wide, and 40¼ inches long, the bottom rail 1½ inches wide and 20½ inches long, including tongues, and the top rail 13⅜ inches wide and 20½ inches long, with tongues. The center upright bars are 26⅜ inches long, with tenons, the half circle 7 inches in diameter and each of the cross bars 7¼ inches long, with ½-inch tenons at each end. Molding is put on as shown and before described.

Maple is usually stained some dark shade and finished with little or no gloss.

TESTS RACERS' ENDURANCE

Eighty thousand foot pounds of energy are used by an athlete in running 100 yards in 11 seconds, according to recent tests.

Dr. Hill found that the pulse rate of an athlete rose to 180 or more a minute during violent exercise, while the heart pumped blood at such times at the rate of fourteen to eighteen gallons a minute.

Recovery is not quite complete until some 60 or 70 minutes have elapsed.

28th YEAR FOUNDED 1899

FREE RAILROAD FARE

LEARN ELECTRICITY *In the Great Shops of* **COYNE**

to $200 a Week

Get in the field that offers you the BIG PAY—BE AN ELECTRICAL EXPERT. Coyne is not a Correspondence School. Everything is practical. No books or useless theory. You do actual work on our huge outlay of electrical apparatus—everything from door-bells to power plants—everything to make you a $60 to $200 a week EXPERT. A Coyne trained man can take his place anywhere in the electrical world. Learn in Chicago, the Electrical Center of the World.

You Don't Need Education or Experience Coyne gives you education and experience by actual work. My training is practical and easy to understand.

Free Railroad Fare and Radio and Auto Course FREE!

Right now I am including a free course in Radio. Also a complete course in Auto, Truck and Tractor Electricity and Storage Batteries and I'll pay your railroad fare to Chicago.

Earn While You Learn—We help students to secure part time jobs to earn a good part of their living expenses while training and assist them to a big pay job on graduation.

SEND COUPON NOW!

Don't delay a minute—send that coupon right now for my big free catalog and full particulars of special offer. No obligation on your part at all. ACT NOW!

COYNE Electrical School
H. C. LEWIS, President
Dept. 6836
1300-10 W. Harrison St.
CHICAGO, ILLINOIS

Mail this Coupon

H. C. LEWIS, Pres.
Coyne Electrical School Dept. 6836
1300-10 W. Harrison St., Chicago
Dear H. C.: Please send me free your big new catalog and full particulars of your **Free Railroad Fare Offer** on all two free courses.

Name.....
Address.....
City.....
State.....

Insure your copy reaching you each month. Subscribe to SCIENCE & INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

FREE!
To Each Purchaser of a WORLD 6 V. Auto or Radio BATTERY
12-Cell — 24-Volt Storage 'B' Battery
Positively given free with each purchase of a WORLD "A" Storage Battery. You must send this ad with your order. WORLD Batteries are famous for their guaranteed quality and service. Backed by years of successful manufacture and thousands of satisfied users. Equipped with Solid Rubber Case, an insurance against acid and leakage. You save 50 per cent and get a
2-Year Guarantee Bond in Writing WORLD Battery owners "tell their friends." That's our best proof of performance. Send your order in today.
Solid Rubber Case Radio Batteries
6 Volt, 100 Amperes $11.25
6-Volt, 120 Amperes 13.25
6-Volt, 140 Amperes 14.00
Solid Rubber Case Auto Batteries
6-Volt, 11-Plate $11.25
6-Volt, 13-Plate 13.25
12-Volt, 7-Plate 16.00
Send No Money Just state battery wanted and we will ship day order is received, by Express C. O. D. subject to your examination on arrival. FREE 'B' Battery included. Extra Offer 5 per cent discount for cash in full with order. Buy now and get a guaranteed battery at 50 per cent saving to you.
WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 19 CHICAGO, ILL.
Approved and Listed as Standard by Leading Authorities including Radio News Laboratories, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories, Radio in the Home, and Lefax, Inc.
World
STORAGE BATTERIES
Set your Radio Dial at 210 meters for the new 1000 w. World Storage Battery Station, WSBC, Chicago. Watch for announcements.

LEARN AT HOME

Now remarkably easy to learn show card writing at home—and tremendously increase your income in a few short months. Merchants, retailers and wholesalers everywhere need clever, original show cards. And through this simple, practical home-study method—written by a foremost show card expert—you can start at once to develop this rich market—and make $20 to $50 a week even in spare time!

No previous training or ability needed. No tedious hours of study necessary. Act now and quickly prepare for the big money opportunities already waiting for you. Many earn from $50 to $100 a week—some even more. Uncrowded field. Pleasurable work. Big profitable business of your own.

Postal brings wonderfully illustrated descriptive booklet with full details of startling profession—absolutely free. Send for it NOW!

WASHINGTON SHOW CARD SCHOOL
Room 269-D 1117-15th St., N.W., Washington, D. C.

Men wanted to manufacture Metal Toys and Novelties

NO SALESMANSHIP NECESSARY

Demand exceeds supply and we co-operate with you in selling goods, also buy them from you. We put you in touch with the buyers. Guaranteed casting forms with complete outfit furnished for speedy production of Toys, Novelties, Ash Trays, Bookends, and other big all-year sellers. Absolutely no experience or machinery necessary. No special place needed. Small investment puts you on road to success. You do the manufacturing and we take care of the selling. Act immediately if you want to handle big 1926 wholesale orders now being placed. Strictly a business proposition. Catalog and information mailed on request.

METAL CAST PRODUCTS COMPANY
1696 Boston Road :: New York

Book Review

ELEMENTS OF RADIO COMMUNICATION, by Ellery W. Stone. Hard covers, 7¾"x5¾", 433 pages. Published by the D. Van Nostrand Publishing Co., New York City. Price, $2.50.

This book takes up, in a very fundamental and systematic way, the elementary principles of radiotelegraphy. The subject is treated in a general manner for the most part, mathematics being resorted to only where necessary to make explanations more complete. Every phase of radio is given proportionate consideration, the author not delving very deeply into the mathematical aspects of any one particular angle of the subject. Transmitters and receivers, from the earliest Marconi types to the present-day high-powered developments are covered in a very comprehensive manner. Freak or fad circuits are purposely not discussed, strict preference being given to the recognized standard ones.

This volume should prove interesting and instructive as a semi-technical general reference on modern radio.

MODEL MAKING, by Cyril Hall. Stiff cloth covers 5"x7¾", profusely illustrated, 139 pages. Published by R. F. Fenno & Co., New York City. Price 75 cents.

One is often impressed with the idea that it is a waste of time to make a model for after all what can a little steam locomotive, perhaps only ten inches long, do in the way of any service, and what is the object of constructing boats that are only twelve inches long, but there is a great deal to it in reality. It gives an admirable training in mechanical construction. It necessitates the study of engineering products, so that at once skill in the use of tools, the study of mechanical and naval constructions, the mechanical drawing and laying out of work, all applies, so that the time is far from wasted. The English model makers probably do the most in this line, and throughout the book we feel that we can discern the English influence to say no more. The book is profusely illustrated; it ranges from the steam locomotive, steamboat and similar things to electricity and to various other models, including, if we may term it a mechanical model, a sailing yacht of the English cutter type. The book contains an adequate index.

LABORATORY EXPERIMENTS IN PHYSICS by Elmer Reginald Drew, Ph.D. and Hermon W. Farwell, A.M. Stiff cloth covers 5" x 7½", 143 pages. Published by The Century Co., New York City. Price $1.50.

Harvard University some years ago issued a synopsis of experiments in physics required for entrance examinations. While they were quite clever, they did seem a little bit elementary. In this book we have detailed a number of much more advanced experiments in use in Stamford University and in Columbia University, the authors being connected, one with a western university, the other with an eastern one. The idea is to give the full directions for experiments in physics and mechanics to be done by the student in the laboratory, not merely for entrance qualifications. The illustrations are decidedly few, but we must picture to ourselves that the student has the apparatus itself in front of him, works with the apparatus itself and that very few illustrations are needed. We do find a diagram of a potentiometer set-up which should be interesting to our radio friends who apply the term potentiometer somewhat too loosely. There is an appendix containing notes on apparatus, and an interesting part of this section describes methods of doing calculations, because there are always liable to be inevitable errors not due to the figures but to what we may call the circumstances of the case.

THE TEXTILE FIBERS, by J. Merritt Matthews, Ph.D. Fourth Edition. Hard covers 5¾" x 9¼", 1053 pages, illustrated. Published by John Wiley & Sons, Inc., New York City. $10.00.

This book is of special interest to the present reviewer, whose recreation happens to involve dealing with the very subject of its pages. A number of very patient souls are now taking up foot-power weaving in an amateur way, and the reviewer is one of those. It therefore follows that this book rather reaches one's heart. It has over one thousand pages and over four hundred illustrations. A most interesting portion treats of artificial silk, which is now coming into such extensive use, although it must be conceded that the durability of its effects is not satisfactory, and the filament of the silk worm surpasses it in quality. Microscopic views of the fibres are found throughout the pages. Mercerized cotton, another modern development, is described in considerable detail with illustrations of the machinery used in making and lustering it.

A HOTEL OF DISTINCTION CATERING TO AN EXCLUSIVE PATRONAGE
The TOURAINE
9-11 EAST 39TH ST.
NEW YORK CITY
Near Fifth Ave.
Within walking distance of shops and theaters
PARLOR, BEDROOM & BATH $8 & $10 per day
PARLOR, 2 BEDROOMS & BATH $14 AND UP
Restaurant a la carte
A. R. SMITH
formerly of
HOTEL ST. REGIS

GET THIS BARGAIN NOW! An Underwood—totally rebuilt—new type; new platen; new finish—and at greatest bargain price ever offered. Five year guarantee! Easiest terms ever—$3 and it's yours!
FREE BOOK! Typist Manual and complete catalog explains whole plan. To first fifty who answer, instructions free in touch typewriting. Mail now to the Shipman-Ward Mfg. Co. 2166 Shipman Bldg., CHICAGO.
Name.....
Address.....

PIMPLES
Cleared Up—often in 24 hours. To prove you can be rid of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers' Itch, Eczema, Enlarged Pores, Oily or Shiny Skin, simply send me your name and address today—no cost—no obligation. CLEAR-TONE tried and tested in over 100,000 cases—used like toilet water—is simply magical in prompt results. You can repay the favor by telling your friends; if not, the loss is mine. WRITE TODAY.
E. S. GIVENS, 468 Chemical Bldg., Kansas City, Mo.

LEARN Aviation
Take a W. A. C. Course in Applied Airplane Engineering. Many men earn $2000 to $10,000 a year. Big Free outfit of airplane parts. Write for Free catalog.
WESTERN AIRPLANE CORPORATION
"Dept. S-9" Monadnock Bldg., Chicago, Ill.

"BECOME A LIGHTNING TRICK CARTOONIST"
Send $1.00 for Beginners Instructions with Laugh Producing Program of 23 Comic Trick drawings. Catalog of Chalk Talk Supplies Free.
BALDA ART SERVICE, Dept. 4, Oshkosh, Wisconsin.

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Place, New York City.

$75 A WEEK BUILDING RADIO SETS In Your Spare Time

Join the Radio Association of America. Learn how to build and repair sets. The Association will train you—start you out in business, if you wish. Be the radio "doctor" of your community. $3 an hour upwards easily made.

EARNS $500 IN SPARE HOURS

"I have at last found myself," writes Lyle Follick, Lansing, Mich. "I have already made over $500." Werner Eichler, Rochester, N. Y., writes, "....have made over $50 a week in my spare time." Our members are starting radio stores, increasing their salaries, securing better positions, passing radio operator examinations, earning big money in spare time.

JOIN ASSOCIATION NOW!

Are you interested in Radio for pleasure or profit? Join now because we have a Special Plan whereby your membership need not cost you a cent. Only limited number of these memberships acceptable. Write now for details—before it is too late.

MAIL THIS COUPON

Radio Association of America,
Dept. 69, 4513 Ravenswood Ave., Chicago
Send me details of your Special Radio Association Membership Plan.
Name .....
Address .....
City ..... State .....

KESTER
READY TO USE
METAL MENDER
The Household Solder

Here's why thousands use Kester Metal Mender.
Simple—"Requires Only Heat" Anyone can use it.
Safe—No messy pots or dangerous acids.
Sure—Genuine Solder makes firm metal joints.
Satisfactory—Works equally well on light or heavy, old or new work.
Economical—Saves many times its price.
Your Dealer Can Supply You

Soldering Booklet "It's a Cinch to Solder" *Upon Request*

CHICAGO SOLDER COMPANY
4201348 Wrightwood Ave., Chicago, U.S.A.

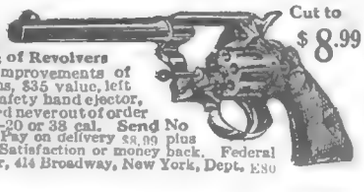
Your Musical Bump will pay You well

START now to develop your talent with a Conn easy-to-play band or orchestra instrument. Demand for players exceeds supply. Free Trial; Easy Payments on any Conn. Send for free literature and details; mention instrument

C. G. CONN, LTD.
956 Conn Bldg. Elkhart, Ind.

CONN BAND INSTRUMENTS

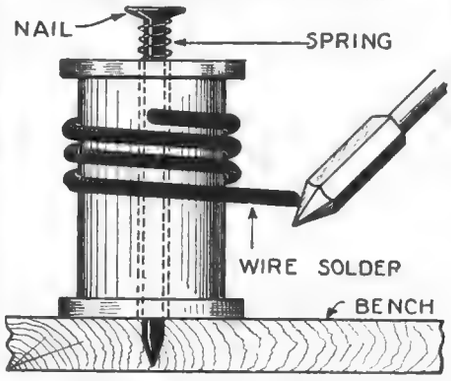
FINAL SALE
King of Revolvers
Has all improvements of latest guns, $35 value, left wheeler, safety hand ejector, guaranteed never out of order 6-shot, 32-20 or 38 cal. Send No Money. Pay on delivery $8.99 plus postage. Satisfaction or money back. Federal Mail Order, 414 Broadway, New York, Dept. E80



Cut to $8.99

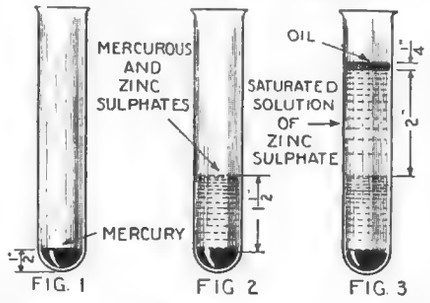
Radio Wrinkles

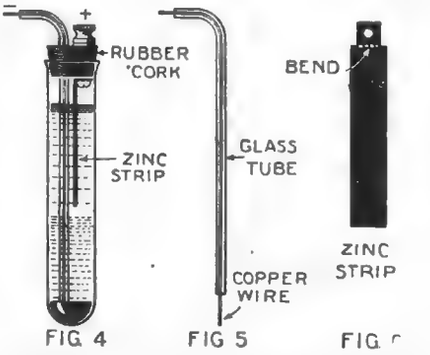
HANDY SOLDER SUPPLY



With this scheme it is always in place and ready for use. A hole is drilled in the spool and the end of a length of wire solder inserted. The solder is then wound on the spool, and is unwound as it is used up. The spool is held firmly in place by means of a nail and a spring. —Clair W. Hudlow.

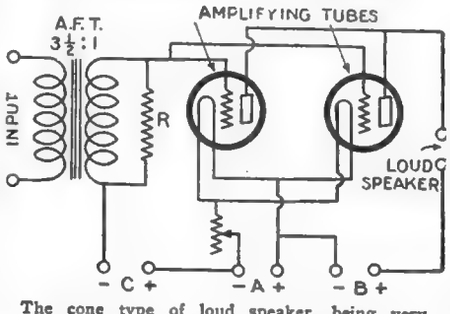
STORAGE "B" BATTERIES



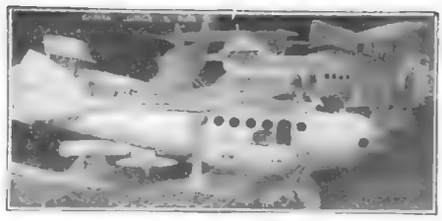


A storage "B" battery made according to the specifications shown will prove very serviceable, since frequent charging will not be necessary. The cells deliver 1½ volts each. When completed, the battery should be charged and discharged three times before being put into service. —Edward Geroux.

POWER TUBE SUBSTITUTE



The cone type of loud speaker, being very sensitive to noises of all kinds, is operated most successfully in conjunction with non-distorting power tube amplifiers. Power tubes being more expensive than the ordinary amplifying tubes, two tubes of the latter variety may be connected in parallel, and thus deliver an undistorted output. —Frank d'Annunzio.



Aviation Brings Quick Success

TO young men of daring no other field of work offers such a fascination, such high pay, nor such opportunities for quick success as the field of Aviation. As yet, aviation is practically in its infancy. But now is the time to get in.

Amazing Opportunities in Airplane Industries

In the automobile industry and in the moving picture business hundreds of men got rich by getting in at the start. They made their success before others woke up. Today, these lines offer no greater opportunities than a hundred and one others. BUT AVIATION IS NEW. Get in while the opportunities are big. All over the country there will be a clamor for trained men. It will not be a question of pay but of getting capable men.

Become an Aviation Expert $50 to $100 per Week

The study of aviation is almost as fascinating as the actual work. Every lesson is full of interest. That is why it is easy to learn aviation. You do not have to make yourself study—it is like reading an interesting book that tells you things you have always wanted to know. Only one hour each evening will give you the basic training in a surprisingly short time.

One student, S. F. McNaughton, Chicago, says: "Your lessons are like a romance, and what is more, after one reading, the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says, "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

Fascinating —Daring— Big Paying
Prepare Now for One of These Positions

Aeronautical Instructor $60 to $150 per week
Aeronautical Engineer $100 to $300 per week
Aeronautical Contractor Enormous profits
Aeroplane Repairman $60 to $75 per week
Aeroplane Mechanician $40 to $60 per week
Aeroplane Inspector $50 to $75 per week
Aeroplane Salesman $5000 per year and up
Aeroplane Assembler $40 to $65 per week
Aeroplane Builder $75 to $200 per week

Personal Instruction
by Experienced Men

Men who have had actual experience give you personal attention. They select the lessons, lectures, blueprints and bulletins. They tell you things that are essential in everyday practice. Each lesson is easy to read and understand.

Get Big FREE Book—Now

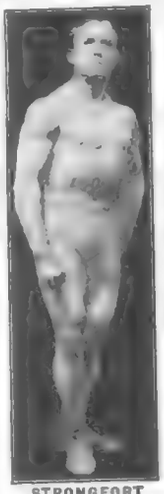
Send coupon below for New Book, just out, "Opportunities in the Airplane Industry." It is interesting and instructive. It will show you many things you never knew before about aviation. We have but a limited supply of these books—send the coupon before they are all gone.

American School of Aviation
3601 Michigan Ave., Dept. 1426 Chicago, Ill.

American School of Aviation
3601 Michigan Ave., Dept. 1426 Chicago, Ill.
Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry", also information about your course in Practical Aeronautics.

Name.....
Street.....
City.....State.....

Are You Afraid of Marriage?



STRONGFORT
Builder of Men

Are you on the verge of plunging into marriage unfit, unprepared for its duties? Are you trembling lest the girl you love discovers that you are not the man she thinks you are? Don't risk such a tragedy. Don't drag any trusting girl into such a mess, wrecking both her life and yours. Stop and think of what marriage means to the unfit—the sickly, skinny, undeveloped!

THINK WHAT IS AHEAD FOR YOU!—disappointment, disgust, divorce, perhaps—and, if you marry and have children—what sort of children can you expect? If you are weak, nervous, sickly, watery-blooded, your children will be rickety, puny, scrofulous, sallow-faced weaklings of whom you will be ashamed.

Brace up, man—make yourself fit for marriage. You can do it.

STRONGFORTISM

—Nature's way to health and strength—will put you on your feet, give you new vigor and a feeling of manliness and make you a man a woman will be proud of. You can come back—no matter how low down, disease and excesses have dragged you. Write today, telling frankly what troubles you.

Send For FREE BOOK

It's a wonderful book of facts about the human body.

—Use this Coupon—

LIONEL STRONGFORT INSTITUTE
Dept. 215 — Newark, N. J.

Send me your FREE BOOK, "Promotion and Conservation of Health, Strength and Mental Energy."

Name .....
Age..... Occupation .....
Street .....
City ..... State.....

Battery Prices
SMASHED!
To Consumers Only

Here is a real battery quality, *guaranteed* to you at prices that will astound the entire battery-buying public. **Order Direct From Factory.** Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a *Written 2-Year Guarantee.* Here is your protection! No need to take a chance. Our battery is right and the price is lowest ever made. Convince yourself. Read the prices!

Auto Batteries		Radio Batteries	
6 Volt, 11 Plate,	$8.50	6 Volt, 100 Amp.	$8.50
6 Volt, 13 Plate,	$10.25	6 Volt, 120 Amp.	$10.25
12 Volt, 7 Plate,	$11.75	6 Volt, 140 Amp.	$11.75

Buy Direct—Send No Money

We ask no deposit. Simply send name and address and style wanted. Battery will be shipped same day we receive your order Express C.O.D. subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Send your order today—NOW!

ARROW BATTERY CO.
Dept. 9 1215 So. Wabash Ave., Chicago

Tire Agents Wanted

Use and introduce MELLINGER CORD TIRES

15,000 MILES GUARANTEED

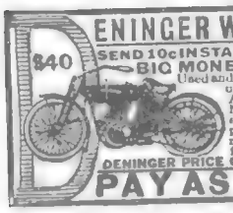
Lowest Wholesale Prices in America. Shipped prepaid on approval. Make big money all or part time. No capital or experience. Sample sections furnished.

YOUR TIRES FREE!

Simply send name today for FREE BOOK, tells how thousands do big business. Special Agents' Offer, Wholesale Prices and FREE Sample Kit.

MELLINGER TIRE & RUBBER CO.
Dept. 411, Kansas City, Mo.
Dept. 411, Philadelphia, Pa.
Dept. 411, Oakland, Calif.

WRITE NEAREST OFFICE



DENINGER WILL TRUST YOU

SEND 10c IN STAMPS FOR CATALOGUES

BIG MONEY SAVING FOR YOU

Used and rebuilt motorcycles $25 to $100, used bicycles $9.50, tandems $20. All machines fully guaranteed. New bicycles and motorcycles at factory prices, save dealers' profits. Motorcycle and automobile tires $3. Complete line frames, engines, supplies.

DENINGER PRICE CUTTER, ROCHESTER, N. Y.

PAY AS YOU RIDE

Hunting Whales With Airplanes

(*Continued from page* 402)

second group (the toothed whales) which includes the Sperm whales, Dolphins and Porpoises, all have teeth, varying in number from a single pair to sixty or more. They feed on fish, squids and cuttlefish.

As will be seen from the foregoing, the whale is just like a human being swimming in water. A man can swim under water for a few minutes holding his breath, and the whale simply goes him one better, having a tremendous pair of lungs, by means of which he can hold sufficient air to oxygenate his blood with while submerged for a period of twenty to thirty minutes. But he may swim under water for five miles in a period of thirty minutes while submerged, and thus it is while hunting whales, the fishermen often are surprised to see a whale dive and then not see him again until he reappears and *blows* several miles away from the ship.

Those interested in whales, one of the most fascinating subjects the writer has ever met with, should certainly read the most remarkable new book entitled, "Whale Hunting With Gun and Camera," by Roy Chapman Andrews.

Some people when they first see a whale or his skeleton, such as those exhibited at the museums, frequently compare the whale with a submarine. They are more correct than they think, for imagine what power a whale has when, after being harpooned, he has fought courageously for ten hours and pulled a 90-foot steam-driven whaling boat after him at a speed of ten miles an hour, when the engines and screws of the whaling boat *were set in full reverse* or *astern.* Many a man has lost his life on whaling expeditions, simply by the swish of a whale's tail at close quarters, this powerful tail crushing him as flat as a flounder. Remember, one swat of his tail represents tons of meat and blubber crashing down upon you. If a whale charges an average small whaling steamer and hits it at right angles, he is quite likely to buckle in the plates and sink the boat. Sixty to seventy tons of solid meat and bones are not to be conjured with when it comes tearing down upon you at a speed of ten to fifteen miles an hour, the average speed of the whale when swimming. In Mr. Andrews' book you will find many instances where whales after having been harpooned have towed the whaling boat for hours, with the boat's engines and screws in half or full reverse. If you live anywhere near a museum where you can see a whale on exhibition, you should by all means go and have a good look at it. They are one of the most awe-inspiring sights you can imagine.

The question is often asked how big is a whale baby at birth, and the common impression seems to be that they are the size of a shark, or 7 to 12 feet in length. The baby whales at birth are most astonishing "little fellows" and would scare you right out of your boots if you ever met one in the water while swimming. The "babies" measure 12 to 25 feet in length, or from ¼ to ⅓ the length of the mother whale when she gives birth to it. Many offspring have been born just at the point where the mother whale is hauled on the pier at land whaling stations; but if the mother expired shortly before, the baby whale is either born dead or is found in the womb of the mother, as the blubber is cut away.

The outer skin of the whale is very interesting, being of a tough, hairless nature about one-half inch thick. The heavy layers of blubber or fat underneath this skin vary from 8 to 12 inches in thickness, and serve to keep the blood of the whale warm.

Free 60-page Reference Book

Mailing List Catalog No. 55

Get Business by Mail

60 pages of vital business facts and figures. Who, where and how many your prospects are.
8,000 lines of business covered. Compiled by the Largest Directory Publishers in the world, thru information obtained by actual door-to-door canvass.
Write for your FREE copy.

R. L. POLK & CO., Detroit, Mich.
680 POLK DIRECTORY BLDG.
Branches in principal cities of U. S.

BUY DIRECT SAVE HALF

HIGH GRADE A QUALITY GOODS at WHOLESALE

SEND for FREE BOOK

Any handy man can install his own plumbing and heating by our new, easy method. Free installing plans show you how. You save waste and high labor cost with our cut-to-fit system. Fifty years of economy service to home owners, farmers, builders and mechanics. Million dollar plants behind our guarantee. FREE BOOK shows everything in plumbing and heating fixtures and supplies. Write today for your copy.

ESTABLISHED 1876

HARDIN-LAVIN COMPANY
104-14 West Pershing Road - Chicago, Ill.

NEW WAY TO GET CHEAP GASOLINE

Now you can cut your gasoline cost as low as 9c a gallon. An amazing new invention makes practically any car give twice its regular mileage. One car did 56 miles on a gallon. The inventor wants distributors and is willing to send a sample at his own risk. Write to J. A. Stransky, L-1500 Stransky Bldg., Pukwana, S. Dak.

RESHAPE YOUR NOSE!

You can safely reshape your nose to beautiful proportions with

ANITA NOSE ADJUSTER

—painlessly, comfortably. Results speedy and guaranteed. Physicians praise it highly. No metal to harm you. Winner of Gold Medal, 1923.

FREE BOOKLET
Write for it today.

THE ANITA CO. Dept 973 ANITA Building Newark, N. J.

4 or 6" Barrel
6-Shot Finest Long Range Revolver

Cut to $5.95

This gun "free" if you can beat our price anywhere—4 or 6 in. barrel, blue or nickel—32, 38-or 22 caliber. Powerful, accurate, hard hitting. Money back guarantee. Pay on delivery $5.95. Federal Mail Order, 414 Broadway, New York, Dept. X80.

You can be quickly cured, if you

STAMMER

Send 10 cents for 288-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering 20 yrs. B. N. Bogue.
8132 Bogue Bldg., 1147 N. Ill. St., Indianapolis

THE MATH PONY

A table of partial products which saves time and mental effort in multiplication and division. To multiply—add. To divide—subtract. Absolutely accurate. Invaluable for students. 25c

MATH PONY, 229 N. Harvey Ave., Oak Park, Ill.

Do Wonderful Chemical Tricks and Experiments with CHEMCRAFT Junior!

Make your own ink, dye cloth, test water and soil, and learn about Chemistry. Surprise and puzzle your friends with Magic Chemical tricks; write secret letters with invisible ink; pour blue, brown and black liquid from a glass of water; make a magic pitcher of blueing; make your own magic writing paper. It's all easy if you have **Chemcraft Junior.** Order now and get a Free copy of The Chemcraft Chemist Magazine; full of chemical information, experiments and pictures. **Order Now — ONLY 50c POSTPAID.** Porter Chemical Co. 105 Summit Ave. Hagerstown, Md.

This Year~ make it a Real Vacation!

Thrilling, foaming speed with the Super Elto outboard motor! Instantly attached to any rowboat. Easily portable. World famous for easy starting. Multiplies the pleasures of fishing, racing, vacationing. Write today for new catalog—beautifully illustrated—intensely interesting.

Elto Outboard Motor Co. Ole Evinrude, Pres. Dept. 18, Motrs. Home Bldg. Milwaukee, Wis.

The Super Elto

"Starts With a Quarter Turn"

SENT ANYWHERE ON 10 DAYS FREE TRIAL

5 TUBE GUARANTEED RADIO

Get Special Offer

BIG POWERFUL MIRACO ultra 5

Users everywhere report it gets programs coast to coast, Canada to Gulf, loud and clear on speaker; outperforms $100 to $250 sets. Many hear Europe. Marvelous value. Let users' testimony convince you. Retail $59.50

FACTORY PRICES-SAVE

1/3 TO 1/2. Smaller Sets $13.75 up, retail. FREE! Literature on latest 1 to 5 tube models, new low prices and SPECIAL OFFER! (Agents, Dealers) Write!

MIRACO RADIO GETS 'EM COAST to COAST

MIDWEST RADIO CORPORATION *Pioneer Builders of Sets* 409-B-E 8th St., Cincinnati, Ohio

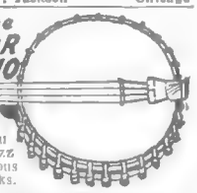
YOUR COAT and VEST can be MATCHED with new TROUSERS

Save the price of a new suit. We match hundreds of coats and vests satisfactorily every day. Every pair tailored to your measure. 60,000 patterns. We submit sample of cloth for your approval. Just mail your vest or a sample of the suit to

Enclose return postage if vest is sent.

ACME PANTS MATCHERS Dept. A8 20 W. Jackson Chicago

Chords on the TENOR BANJO



FREE INFORMATION

Our Special Course, enables you to learn chords and latest jazz ideas immediately—By the famous John Martell, author of many books.

N. Y. Institute of Music, Dept. S, 143 E. 34th St., N. Y. C.

Learn Photography at HOME

Earn $3000 to $10,000 a year. Prepare quickly during spare time. Also earn while you learn. New easy method. Nothing else like it. Send at once for free book, "Opportunities in Modern Photography" and full particulars. Special offer now.

INTERNATIONAL STUDIOS, Inc. Dept. 1428 3601 Michigan Ave., Chicago, U. S. A.

BIG BOOK 10c!

Be a Man of Mystery! Amaze and Mystify your friends. Easy to learn. This New 80-page Copyrighted Book tells how. Large Catalog of Magic Tricks, Jokes, Puzzles and Imported Novelties included. Send 10c today!

LYLE DOUGLAS Station A-3, Dallas, Texas

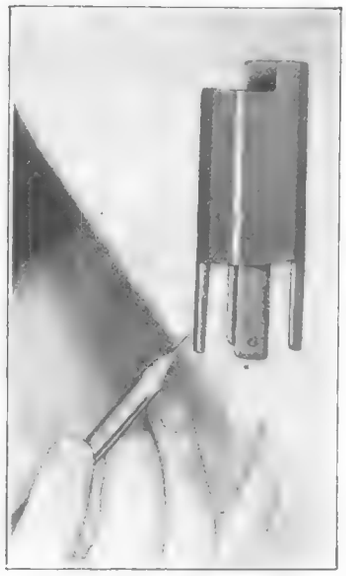
SQUAB BOOK FREE

Breed squabs and make money. Sold by millions. Write at once for free 40-page book beautifully printed in colors telling how to do it. *You will be surprised.* PLYMOUTH ROCK SQUAB CO. 506 H St., Melrose Highlands, Mass.

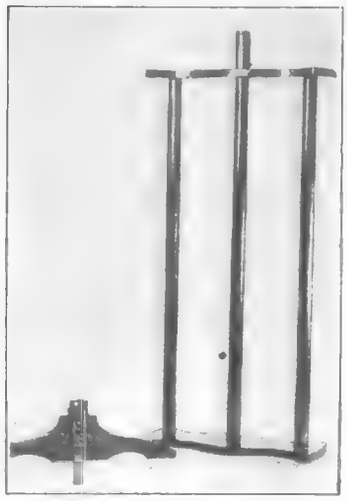
Building a Good Box Loop

By HERBERT E. HAYDEN

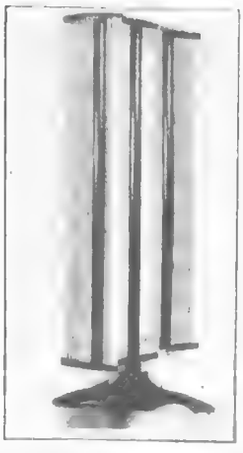
(*Continued from page* 438)



A brass bushing ¾" inside diameter, notched as shown above, is fitted over the keyed base members and acts as a socket for the center dowel stick.



The photograph above shows the appearance of completed frame of loop, after it has been rubbed down and finished with a coat of varnish or dye.



Here is a completed loop assembled and wired with standard silk covered loop wire. This loop is the equal in appearance and efficiency of any commercial type.

$95 an Hour!

"Every hour I spent on my I. C. S. Course has been worth $95 to me! My position, my $5,000 a year income, my home, my family's happiness—I owe it all to my spare-time training with the International Correspondence Schools!"

Every mail brings letters from some of the thousands of I. C. S. students telling of promotions or increases in salary as the rewards of spare-time study.

What are you doing with the hours after supper? Can you afford to let them slip by unimproved when you can easily make them mean so much? One hour a day spent with the I. C. S. will prepare you for the position you want in the work you like best. Yes, it will! Put it up to us to prove it. Mark and mail this coupon now!

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6163-E, Scranton, Penna.

Oldest and largest correspondence schools in the world

Without cost, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....

Street Address.....

City..... State.....

Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

SEND FOR THE INTERNATIONAL CATALOG

Our net price list. Full line of auto bodies and accessories for Fords at **Wholesale Prices.** Save big money on bodies by buying Direct from Factory.

FOR FORD—Prices from $27.85 up. Factory to consumer direct—Pay only One Profit.

International Body Works, 914 W. Ohio St., Dept. 4, Chicago, Ill.

Ship Model Plans

and instructions. Easy to build and sell models. Magellan's Ship, 77c—Hudson's "Half Moon," 92c—Clipper, 82c—Santa Maria, $1.02—Pirate Ship, 52c—all for $3.90.

SEA ARTS GUILD

405X ELEVENTH AVE. MILWAUKEE, WIS.

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the November issue must reach us not later than September 10th.

The Circulation of Science and Invention is over 150,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York City, N. Y.

Advertising Agencies

24 Words—355 Rural Weeklies $14.20. Ad-Meyer, 4112-81 Hartford, St. Louis, Mo.

Advertising in all magazines and newspapers at publishers lowest rates. Book giving rates, closing dates, etc., 25c.—refunded first order. Taylor's Advertising Service, 314 Brown Bldg., Rockford, Ill.

Advertisers

I Write letters, folders, booklets, complete followup for manufacturers, mail order dealers. Long experience. Write for details. L. Taylor, 315 Brown Bldg., Rockford, Ill.

Agents Wanted

Agents—Best seller; Jem Rubber Repair for tires and tubes; supercedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Philadelphia, Pa., Dept. 601.

If I send you a Suit made in the latest style from the finest goods, will you keep it, wear it, and show it to your friends as a sample of my sensational $23.50 suits guaranteed regular $50.00 values? Could you use $3.00 an hour for a little spare time? If so, write me at once for my wonderful new proposition. Just write your name and address on a card and mail to Dept. 335, Salesmanager, 133 So. Peoria St., Chicago.

$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Bankrupt and Rummage Sales. Make $50.00 daily. We start you, furnishing everything. Distributors, Dept. 171, 609 Division, Chicago.

Wash clothes the new way. Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3602 Enright Ave., St. Louis, Mo.

Make Money Silvering Mirrors, refinishing auto headlights, tableware, metal plating, bed steads, chandeliers. Outfits furnished. International Laboratories, Dept. 69, 309 Fifth Ave., New York.

Agents—New Plan, makes it easy to earn $50.00 to $100.00 weekly, selling shirts direct to wearer. No capital or experience needed. Represent a real manufacturer. Write now for FREE SAMPLES. Madison Company, 566 Broadway, New York.

Salesmen Selling to Men. We have logical side line for you that will sell along with any other line you may now be handling and probably make more money for you, provided you are now selling to men. Get full facts at once by addressing Sales Manager, 850 West Adams, Dept. 932, Chicago.

Real Selling Sensation! Tremendous earnings whole or part time! Patented Hot Water Bottle Invention needed everywhere. Big commissions. Extra bonus. We deliver. Write quick. C919 Lobl Corp., Middleboro, Mass.

Gold initials, easily applied on Automobiles. Biggest moneymaker today. Cost 5c, you get $1.50. No experience needed. Free Samples. "Ralco" Monograms, 1043 Washington, Boston, Mass.

To sell Ray-O-Lite cigar and gas lighters. Big earnings. Sample 50c. Rapid Mfg. Co., 799-L Broadway, New York.

Agents—If you write at once we can place you as our local representative. $15 a day for full time; $2.00 an hour spare time. Exclusive territory; automobile furnished. An exceptional opportunity—investigate immediately. American Products Co., 6121 American Bldg., Cincinnati, Ohio.

Big season on. Rhinestone Initial Buckles sell on sight. $15.00 daily in advance. No investment. Exclusive territory. Chaton Novelty Co., 606 Blue Island, Chicago.

Agents over 100%! Sell quality dresses $2.00 each. Make $13.00 dozen. Sales outfit free. Trial sample $1.00 C. O. D. Economy Sales, 2512, Boston, Mass.

Agents: Our new household cleaning device washes and dries windows, sweeps, cleans walls, scrubs, mops. Costs less than brooms. Over half Profit. Write Harper Brush Works, 504-3rd St., Fairfield, Iowa.

Boston Maid Frocks for Women and Children—nationally known—famously popular. From mill to wearers $3.50 to $20. Great income producers for men and women agents. Write for selling outfit. Bosworth Mills, B-18, Melrose, Mass.

Can You Organize? A sales Force? Are you a salesman? Do you want to become one? Have real opportunity for you. Your time, combined with our plan, will give you the most money you ever made. Write Furst-McNess Co., 508, Sunlight Bldg., Freeport, Ill.

Agents Wanted (Continued)

Make-Sell Your Own Goods. Formulas, Processes. All kinds. All lines. Catalog, circulars free. D. Thaxly Co., Washington, D. C.

A Paying Position Open to representative of character. Take orders shoes—hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co., 7-468 C St., Boston, Mass.

Fifty weekly easy Circulating magazine clubs, Instruction lists free. Spencerarch Agencies, W. Los Angeles, Calif.

Agents—Biggest money makers ever offered. Sell offices, homes BESTUFONE, which makes both hands free while telephoning; MIDGET COLLAPSIBLE GARMENT HANGERS which everybody wants; and EVERIN Keypurse to hold change and keys. P. Kalina Company, 1308 Avenue N, Brooklyn, N. Y.

"New camera finishes regular black and white photographs inside camera quickly. Make money taking photos, selling cameras. Crown, 439 Canal, Dept. 310, New York."

Sell by Mail! Big Profits! Books, Formulas, Novelties, Bargains. Particulars Free. Elfco., B-523 S. Dearborn St., Chicago, Illinois.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 71, East Orange, N. J.

Airplanes, Aviation

Three foot flying model aeroplanes, 12 inch mounted propeller for 25c. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

Airplanes. How to build them and be sure they will fly. Learn the two most powerful influences on the stability and operation of an airplane, get our free information, blue prints and propeller literature. Crawford Airplane Manfgr., 2225 American Ave., Long Beach, Calif.

Curtiss Pulitzer Racer construction set, including plans and genuine Curtis Reed propeller $1.00 postpaid. Special offer: Scientific airglider with ground launching device 50c postpaid. Curtiss plans 35c S. E. V. 75c—Leoning 75c. Big catalog listing latest types of model airplanes, boats and supplies 5c. Phipps Company, 367 Wilson Ave., Brooklyn, N. Y.

Battle Photos and War Relics

For Dens. Relics from Europes battlefields (also medals). Illustrated catalogue (with sample war photos) 25c. Welch, 1889 Albany Ave., B'klyn, N. Y.

Future Aviators—Attention! Short cut information on Flying—Costs—What to buy. Condensed facts on aviation. Ex Army & Commercial fliers. 9 yrs. experience. Send $1.00 for course. JELKS & HAY, 2734 S. Normandie, Los Angeles, Calif.

Books

Hypnotism: 25 Easy lessons and 218 pages illustrated reference guide $2.00. "Mind Reading", (any distance) Wonderful $1.10. Science Institute, SV430 Milwaukee Ave., Chicago.

Business Opportunities

Free Book. Start little Mail Order business. Pier, 996 Cortland Street, New York.

You can have a business-profession of your own and earn big income in service fees. A new system of foot correction; readily learned by anyone at home in a few weeks. Easy terms for training, openings everywhere with all the trade you can attend to. No capital required or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

Stop Plodding! Be Successful. Operate a Tire Repair Shop. Make big profits in any locality. We teach you and furnish complete equipments $100 up. Book of Opportunity free. Haywood's, 1312 South Oakley Avenue, Chicago.

Responsible Manufacturer wants competent men to manage office and salesmen. $300 to $1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

Succeed—Our twenty scientific processes put you wise. Excellent. 50c. No stamps. Holland, Box C-473, Astoria, Oregon.

Stocks—Bonds, Domestic-Foreign, bought-sold. Dealers in all marketable securities. Frank X. Everett & Co., 20 Broad St., New York.

Built-for-you business plans. All kinds. Guaranteed. Particulars 10c. Pemco, Box 306, Franklin, Pa.

Be your own boss. Unlimited opportunities in Mail Order work! Send for our book on Mail Order plans. Also a $5 book containing 100 reliable money-making plans. Both sent on the receipt of $1. A Kandel, 817 W. 28th Street, Norfolk, Va.

Business Opportunities (Cont'd)

Be a Laboratory expert. Earn from $300 to $500 monthly. Study Microbiology. Sanitation. Day, Evening classes. Diplomas, Degrees. Granted 71 Piece outfit Free to students. Write for our Free Prospectus to-day. International College of Microbiology. 7202 W. Grand Ave., Chicago, Ill.

Free Book—Start little mail order business. Popham, Box 431, Chicago.

Business Service

Representation in Washington, D. C. Mail address, Information, Anything, Anytime, Service, 223-Victor Bldg.

Chemistry

Experimenters! Students, Amateur Chemists! Read "Popular Chemistry" for experiments, formulas, chemical news, book reviews, chemical magic. Question and answer department every month. Subscription, $1.00 year. Sample, 10c. Special—Eight copies, all different, including How to Make Fireworks and Lessons in Determinative Mineralogy, 50c (money order). Wright Press, Caldwell, New Jersey.

Experimenters, Chemical Apparatus—Radio catalogs. 1000 illustrations. Price 25c refunded on $5.00 order. Laboratory Materials Company, 635 East 71st St., Chicago.

Correspondence Courses

Used correspondence school courses. All kinds. Sold on repurchase basis. Big saving. Money back guarantee. Lists free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Educational

Correspondence courses. All schools. Lowest prices. Terms. Catalog Free. Mention Subject. Fred. Goetz, 440-M Sansome, San Francisco.

Send $1.00 for My Book "An Explanation of Life and Mind." P. Elie Kalanin, 35 W. Thomas St., Miner's Mills, Pa.

Farms, Land, Etc.

Ozark land: 10 acres near White River and proposed Dixie Lake, $100, $5 monthly. Asa Zimmerman, 1800 N. Fifth, Kansas City, Kansas.

For Inventors

Inventors—Get this pamphlet, "What to Invent." No theory or guess work, but things actually asked for by manufacturers. Sent prepaid for only $1.00. Inventor's Syndicate, 22 Paladium Bldg., St. Louis, Mo.

U. S. and foreign patents, trademarks, moderate rates, 22 years experience. George C. Heinicke, 32 Union Square New York, registered in U. S. and Canada.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 808 Jenifer Bldg., Washington, D. C.

Inventors! Use our special service for presenting your invention or patent to manufacturers. Adam Fisher Mfg. Co., 205-A Enright, St. Louis, Mo.

Your Chemical problems solved and working process furnished for Five Dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

Games and Toys

Boys! Boys! Boys! Just issued, our 1926 catalog of Jewelry, Tricks, Puzzles, Novelties. Write for your copy. Dept. 6, American Bazaar, Inc., 640 B'way, New York.

Gift of Orient

Send "Flowers of Paradise" Incense. $1. Blossom Gift Shoppe, Southwest Bldg., Los Angeles, Calif.

Help Wanted

Silvering Mirrors, French plate. Easily learned, immense profits. Plans free. Wear Mirror Works, Dept. 36, Excelsior Springs, Mo.

All men-women, 18 to 60, wanting to qualify for Government Positions, $140-$250 monthly. Local or traveling, write. Mr. Ozment, 293, St. Louis, Mo.

Detectives Earn Big Money. Travel. Excellent opportunity. Great demand everywhere. Experience unnecessary. Particulars free. Write. American Detective System, 1974 Broadway, N. Y.

Be a Detective. Work home or travel. Experience unnecessary. Particulars free. Write, George Wagner, former Government Detective, 1968 Broadway, N. Y.

Men—Women, 18 up. Get U. S. Government Jobs. $95 to $250 month. Steady work. Life positions. Paid vacation. Experience unnecessary. Common education sufficient. Full particulars, 32 page book, and sample coaching FREE. Write today sure. Franklin Institute, Dept. A19, Rochester, N. Y.

Inventions Wanted

Will buy approved invention. Write W. L. Kendig, 416 N. Duke Street, Lancaster, Pa.

Machinery and Tools

Concrete Building Block Machines and Molds. Catalogue free. Concrete Machine Co., 5 N. First St., St. Louis, Mo.

Magic and Games

Free with $25 order our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapes, Oaks Magical Co., Dept. 549, Oshkosh, Wis.

Books—Magic, Mysteries, Magic Tricks, Novelties, Catalogue Free. Singer, 200, Hancock, Wis.

Manufacturing

To Order—Mechanical work, all branches. Models, Experimenting. Quantity production. Parma Engineering Works, Brooklyn Station, Cleveland, Ohio.

Manuscripts Wanted

Earn $25 weekly, Spare time, writing for newspapers, magazines. Experience unnecessary. Details Free. Press Syndicate, 987, St. Louis, Mo.

Miscellaneous

Beautiful registered bull pups $15. Bulldogs, 501 Rockwood, Dallas, Texas.

I Catch From 45 to 60 foxes in from 4 to 5 weeks' time; can teach any reader of this magazine how to get them. Just drop me a card for particluars. W. A. Hadley, Stanstead, Quebec, Canada.

Handmade polychromed art plaques, size 9¼"x6¼" 50c. 10"x12" $1.00. Gilt Paintings. G. H. Conroy, Lake Geneva, Wis.

Build yourself an electric clock! Blueprints and instructions for a novel model, $1. Particulars free. Albert Delbig, Electrical Engineer, 1690 Park Ave., New York.

Models and Model Supplies

Scale locomotive castings and track. Racing marine engines, boilers and speedboat construction sets. Small hexagon bolts and nuts. Castings from your patterns. Seamless steel copper and brass tube, rods, bars, angles. Any length cut. Singer, 15 Moore St., New York.

Motorcycles—Bicycles

Don't buy a Bicycle Motor Attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Motorists

Adams Oxygen Tablets—positively, quickly, harmlessly removes carbon from pistons, cylinders, valves while car runs. Saves gas and oil, eliminates valve grinding, stops knocking and pre-ignition. $1.00 postpaid. Money-back guarantee. Boone Specialty Co., 110 W. 112th Place, Chicago, Ill.

Musical Instruments

Violins—Deep, Mellow, Soulful—on easy credit terms. High grade, wonderful instruments of my own make. Development of many years' expertness. Write for book. Gustav A. Henning, 2424 Gaylord St., Denver, Colo.

Old Coins

California Gold, quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Shultz, Box 116, Colorado Springs, Colo.

German Govt. Bond. 100,000 Mk. 1923 $1.40, 5,000,000 Mk bond 1924, $1.50. 100,000 Mk. bill and catalogue 10c. Norman Shultz, Colorado Springs, Colorado.

Patent Attorneys

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Victor Bldg., Washington, D. C.

Richard E. Babcock, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C. Booklet.

Monroe E. Miller, Ouray Bldg., Washington, D. C. Patent Lawyer; Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorney in United States and Canada, 212 Ouray Bldg., Washington, D. C.

Patents Procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 41-T Park Row, New York.

Patents. Send for free booklet. Highest references. Best results. Promptness assured. Send model or drawing for examination and opinion. Watson E. Coleman, Patent Attorney, 644 G Street, N. W., Washington, D. C.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 809 Jenifer Bldg., Washington, D. C.

Get your own patents. Application blanks, complete instructions $1. Cutting Bros., Campbell, Calif.

—PROOF—

That Classified Advertising in *Science & Invention* Pays

THE RALCO SUPPLY CO.
Easily Applied and Permanent Monograms,
Boston, Mass.

SCIENCE & INVENTION: June 28, 1926.

Sometime ago you asked us for a testimonial. We wish to advise you that we have not been keying Science & Invention for quite some time, as it has been one of our pick of choice in the past.

We believe it reaches the right class of Agents, as we have good results from men obtained through your paper, as does the Agent.

Thanking you, we are

Very truly yours,
THE RALCO SUPPLY CO.

—still another one

OAKS MAGICAL CO.
Manufacturers of Advanced Magic
Oshkosh, Wis.

Jan. 25, 1926

SCIENCE & INVENTION:

In replying to your recent letter regarding our advertisement appearing month after month in your publication, will say that the results have always come out way on top.

Very truly yours,
OAKS MAGICAL CO.
Per H. G. Harwood

See Rates at Top Opposite Page Then Send Your Order.

Patents. Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for Free Book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, Security Bank Building (directly across street from patent office), Washington, D. C. See page 453.

Patents: Trade-Marks. Ten years experience in Patent Office. Consultation invited. Booklet. Geo. Beeler, 2001, 150 Nassau St., New York.

Inventors—who derive largest profits know and heed certain simple but vital facts before applying for patents. Our book Patent-Sense gives those facts; free. Write Lacey & Lacey, 644 F St., Washington, D. C. Established 1869.

"Inventor's Adviser," the valuable Patentbook with 139 Mechanical movements and illustrations, sent free upon request. M. I. Labiner, Patent Attorney, 3 Park Row, New York.

"Inventors' Guide" free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Ledermann, Registered Attorney and Engineer, 17th Floor, Woolworth Bldg., New York.

Patents

Inventions commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Two Inventions—an automaton and a plaster paris process. Beware inventor's rights. William Haines, Habana, Cuba.

Photography

Have you a Camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 118 Camera House, Boston, 17, Mass.

Photoplays Wanted

$$$ For Ideas. Photoplay Plots considered in any form. Write for free booklet. Universal Scenario Company, 223 Security Bldg., Western and Santa Monica Blvd., Hollywood, Calif.

Printing, Printing Outfits and Supplies

Print your own cards, stationery, circulars, paper, etc. Complete outfits $8.85; Job Presses $11, $29; Rotary $149. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Kelsey Company, F-6 Meriden, Conn.

Sell Printing. Low prices. High quality. Large commission. Send 10c for folio. Ozark Press, Joplin, Mo.

Gummed Labels, Name and Address, 500, 2 lines 30c. 3 lines 50c. Catalogue. Eastern Label Co., Y, Clintonville, Conn.

Salesmen Wanted

Salesmen: Go into business without investing a penny. No rent to pay. No stock to carry. Yet you make bigger profits than regular storekeepers. Write for facts at once. Address Dept. 531 Goodyear Chicago, Inc., 844 W. Adams St., Chicago.

Take orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 83, Chicago.

Minutes Pay Dollars demonstrating wonderful three pound calculator. Details $15.00. Work equals $300 machines. Adds, subtracts, multiplies, devides automatically. Five year guarantee. Big demand; large profits, experience unnecessary. Write quick for liberal trial offer and protected territory. Lightning Calculator Co., Dept. W, Grand Rapids, Mich.

We have a line of goods for which every man in America is a prospect. It has everything any competing line has and something besides. It can be handled profitably by tailoring, shirt, hosiery, necktie, shoe, raincoat, and other salesmen now selling to men. For full facts, address Madison Bros., 135 So. Peoria, Dept. 20, Chicago.

$100-$200 weekly. Retailers live wire specialty. $10 weekly guaranteed against com. Reliable house. Guarantee dealers turnover or money back. Pay you to investigate. Appleton Novelty Co., Cedar Rapids, Iowa.

Sells for $9.75. Prints ad on wrapping paper, envelopes, etc. $4.00 commission. Send 10c for sample work. Automatic Ad-Stamper, Joplin, Mo.

Salesmen: Sell new changeable letter signs, exclusive or side line. Sample $1. World Signs, 108 N. Dearborn, Chicago.

$7.00 an hour actually earned in spare time selling for the largest direct-to-wearer shoe firm in the world. $5.00 values at $2.95. Write quick for free particulars. The Double-Wear Shoe Co., Minneapolis, Minn.

Song Poems

Song Poem Writers—Send for proposition. Ray Hibbeler, D24, 2104 N. Keystone Ave., Chicago.

Song Poem Writers: Stamp brings, "Song Writers Guide". Wm. Van Beaver, B21, 1239 Elm St., Green Bay, Wis.

Song poems wanted. Radio Publicity, Bureau S, 24 Times Square Station, New York.

Stammering

St-Stu-T-T-Tering and Stammering Cured at Home. Instructive booklet free. Walter McDonnell, 105 Arcade, 1126 Granville Ave., Chicago, Ill.

Stop Stammering, increase salary. Descriptive booklet free. Samuel Robbins, 399 Boylston St., Boston.

Stamps and Coins

Stamps 100 All Different 3 cents. S. I. Quaker Stamp Company, Toledo, O.

Typewriters

Typewriters, all standard makes. $10 up. Fully guaranteed. Free trial. Write for complete illustrated lists. Northwestern Exchange, 121 N. Francisco Ave., Chicago.

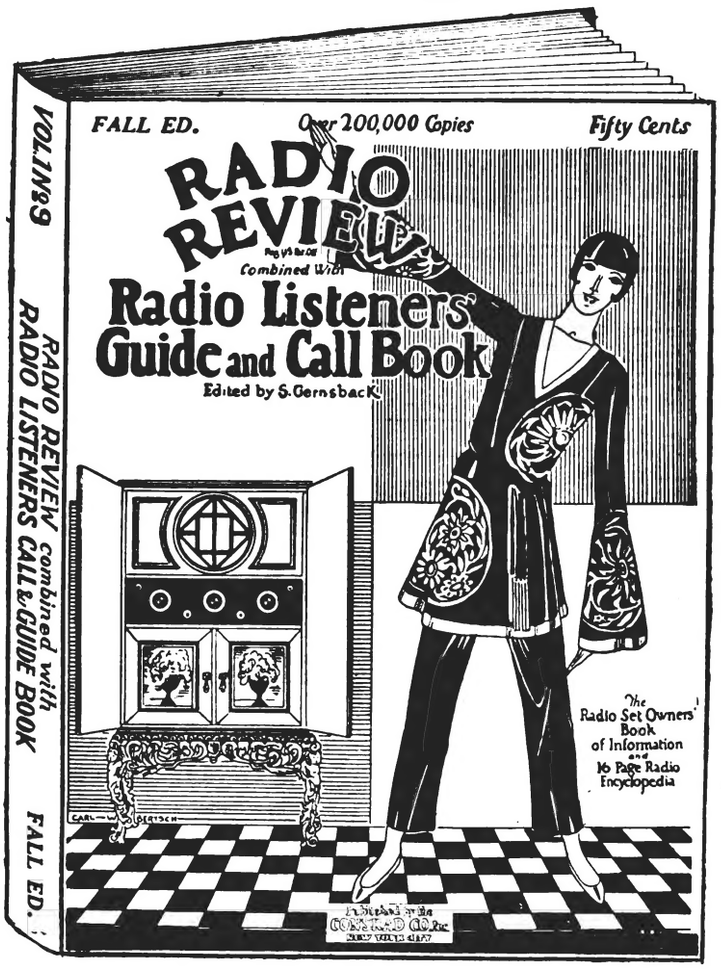
Wanted

Detectives Earn big Money. Work home or travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968 Broadway, N. Y.

Watch for the Big FALL Issue!

50c

THE COPY


FALL ED.
Over 200,000 Copies
Fifty Cents
RADIO REVIEW
Combined With
Radio Listeners' Guide and Call Book
Edited by S. Gernsback
VOL. IN 9
RADIO REVIEW combined with RADIO LISTENERS CALL & GUIDE BOOK
FALL ED.
The Radio Set Owners' Book of Information and 16 Page Radio Encyclopedia

SOLD ON ALL NEWS-STANDS

Contents

BROADCAST STATIONS OF THE U. S.
(Alphabetically by call letters)

This section contains all the Broadcast Stations of the United States listed by Call Letters, giving location, Power, Wavelength, time and hours of operation.

BROADCAST STATIONS OF THE U. S.
(By Wavelength & Frequencies)

This is a complete list of Broadcast Stations of the U. S. same as above, but listed numerically by Wavelength for added convenience.

BROADCAST STATIONS OF THE U. S.
(By States & Cities)

Another way of listing all U. S. Broadcast Stations. Especially valuable when location of a given station is known but the call letters indestinguishable by Radio.

CANADIAN RADIO BROADCAST STATIONS
(By Provinces & Cities)
(By Call Letters)

This section contains the finest revised list of all Canadian broadcast stations obtainable. Listed two ways.

FOREIGN RADIO BROADCAST STATIONS
(By Countries & Cities)

A section containing the latest, most complete list of Foreign Broadcast Stations ever published.

The Radio Listeners' greatest Call Book—and Book of information COMBINED

Imagine the finest, most up-to-date list of Radio broadcast stations obtainable—listed 3 ways for convenience and giving the operating hours of each station—add a dozen fine articles on the operation and care of Radio sets—More fine constructional articles and lastly a complete installment of S. Gernsback's Radio Encyclopedia—and you have the big, new Fall RADIO REVIEW—192 pages, large size 9x12 inches. Photographs of all living Broadcast Performers and Announcers and hundreds of interesting illustrations.

Contents

RADIO SET OWNERS BOOK OF INFORMATION

In this portion of Radio Review are a large number of selected articles each of great value to every Radio Listener whether he be a beginner, Amateur, Professional.

RADIO EXERCISE CHARTS

A guide to Radio Exercises containing helpful charts of actual exercises and similar information.

CONSTRUCTION OF MODERN CIRCUITS

Here is one of the latest additions to the great Radio Review—gives complete details with drawings on how to build at home the latest Radio Receivers.

S. GERNSBACK'S RADIO ENCYCLOPEDIA

Radio's finest Encyclopedia—One complete installment given in every issue of Radio Review—contains a whole barrelful of actual, authentic data and information on Radio from every angle.

ILLUSTRATIONS

Throughout the broadcast station lists are hundreds of illustrations of living performers and announcers, together with photos of broadcast stations.

THE CONSRAD COMPANY, Inc.,
64 Church St., New York, N. Y.

Gentlemen:—I enclose 50c for one copy of the new FALL ISSUE of RADIO REVIEW.

NAME .....

ADDRESS .....

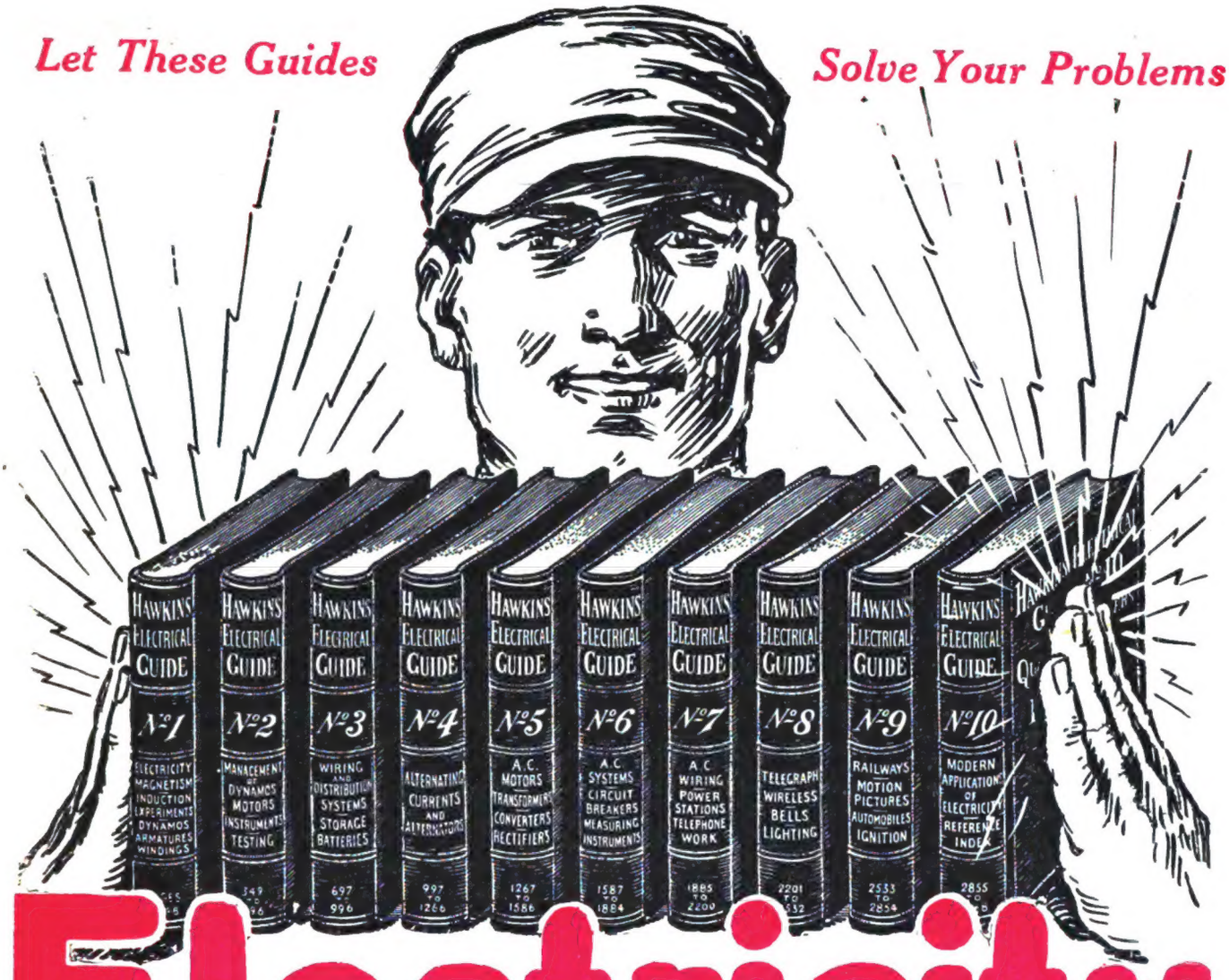
CITY, STATE .....

IF YOUR DEALER CANNOT SUPPLY YOU USE THIS COUPON

The Consrad Co., Inc.

Church Street, New York, N. Y.

Let These Guides *Solve Your Problems*



Electricity at your finger ends

HAWKINS ELECTRICAL GUIDES IN TEN VOLUMES

3500 PAGES
4700 PICTURES

$1 A VOLUME
$1 A MONTH

SEND NO MONEY—SEND ONLY THIS COUPON

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.

LEARN ALL ABOUT

Magnetism—Induction — Experiments — Dynamos — Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters—Rectifiers—Alternating Current Systems — Circuit Breakers — Measuring Instruments—Switchboards—Wiring—Power Stations—Installing —Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the ten numbers.

SHIPPED FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth $100 to you—you pay $1.00 a month for ten months or return it.

THEO. AUDEL & CO.
65 West 23rd Street, New York City

Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price $1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Name .....

Occupation .....

Employed by .....

Home Address .....

Reference .....

S. I., SEPT.

J. A. Rosenkranz President says..

"I want men and boys to train for BIG PAY Electrical Jobs ...in California"

This Big Book of Facts Tells the Story

In this book I've written exactly what you will do and learn at National. A photographic trip through this 3-acre school of shops and laboratories. The Truth about your opportunities. To keep the book from curiosity seekers I charge Easterners $1 a copy—which is deposited to your account at 5% interest until you come to school. If you live in the West and can come to National NOW—I'll send you this $1 book Free!

FREE to men west of the Mississippi

$1.00 to Easterners. The $1.00 will be deposited to your account at 5% interest

There are hundreds of high-paid electrical jobs begging here in California! Employers are asking me to supply them with trained men. So I offer you the opportunity to come to Los Angeles, get practical training in my big shops and fill one of these jobs before 1927!

If you're ambitious to make money I'll guarantee to make you a *real* Electrical Expert. My training method is internationally famous for its thoroughness. I've trained 16,000 men—from all parts of the world—to hold fine jobs at big pay. You perform all kinds of electrical work here on $1,000,000.00 worth of new equipment, with expert instructors helping you. You *know how*—when you leave National. That's why big employers are anxious to hire my graduates.

Unless You Pass This Test You Can't Come to National

I'm sincere about this Big-Pay-Job Offer—and so I must limit this opportunity to ambitious men who are willing to spend enough time to learn electricity *right*. I don't want any half-trained men to represent National. You must pay your fare to Los Angeles—pay living expenses or work at part time jobs while learning—and pay a reasonable training fee when you enter school. These obstacles will not daunt the man who is determined to be a success—and I have special jobs and savings plans to help earnest men who lack funds.

Over a half million dollars worth of new electrical equipment which you learn to operate in the three acres of National shops and laboratories.

The Most Unusual Electrical Training in America

You get absolutely thorough, complete training at National. You are not rushed through. You master every job. Lifetime scholarship entitles you to stay as long as you like and come back after graduation for extra training free. This school's success is based on the highest-quality training possible. No expense spared to train you right. Endorsed by leading educators, electrical associations and employers, who say, "National produces the best trained men."

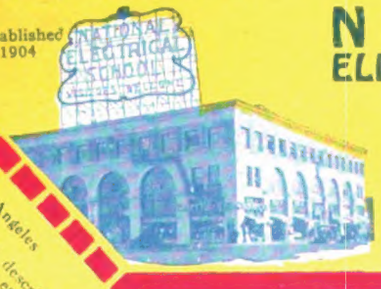
Los Angeles Is Magic City of Opportunity

World's largest hydro-electrical projects surround Los Angeles. Constant demand for Electrical Experts. National graduates supply this demand. Ideal climate—beaches—mountains—sports—amusements year 'round. Your Big Opportunity awaits in California. Grab a train and come—NOW!

FREE Employment Service—Earn While Training

You can earn board and room while at National by new cooperative plan of practical work in leading electrical and auto shops in spare time. We help you land big-pay job after graduation and find new openings for you as you advance. Send for catalog with full details of how National helps you to succeed.

Established 1904



NATIONAL ELECTRICAL SCHOOL
Dept. A 326
Santa Barbara and Figueroa Sts.
LOS ANGELES, CALIFORNIA

NATIONAL ELECTRICAL SCHOOL, Dept. A326, Santa Barbara & Figueroa Sts., Los Angeles

Send me your free 64-page Electrical Catalog describing National quality training methods. (If you live east of the Mississippi enclose $1.00 which will be deposited to your credit at 5% interest.)

Name .....

Address .....

City .....

State .....

Tours World as Radio Operator

"Passed Commercial Radio Operator's Examination with highest marks. Am starting at once for India, the Orient and Africa as 1st Class Comm'l Radio Oper. And only a few months ago I was an Iowa farm hand. I investigated three schools and traveled 2000 miles to get to National. Because of your thorough training I can also qualify as Chief Ship's Electrician." **C. R. Cunningham.**

"Six Months at National Saved Me SIX Tedious Years as Apprentice."

"I passed Electrical Inspector's Examination and Electrical Repairmen's Examination for Civil Service with high grades. Only 27 men out of 134 passed the inspector's Examination. I was eighth highest in Repairmen's Examination out of 126 men.

"Now I have several splendid positions open with big pay and advancement. Yet I trained for only six months at National—and can fill these jobs better than other men who have worked for years as apprentices. I saved six years' work by going to National and I am certainly thankful I decided to take your short cut to success." **Alex Johnson.**

"My Civil Service Exams. Made Easy by National Training"

"My grade of 95% was fourth highest among 140 men who took the Electrical Mechanic's Civil Service Examination. As this examination was supposed to be for men with at least two years practical experience, my marks created a sensation at the Commissioner's Office.

"I found the questions easy because of my National training. The best move I ever made was entering your school. Because of my thorough training I am going to take the Junior Engineer's Exam. too. I find that my few months at National saved me at least five years as an apprentice doing tedious jobs." **E. C. Small.**